



PA-8500 Continuum Series 400 Technical Service Guide

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Manual Name: *PA-8500 Continuum Series 400 Technical Service Guide*

Stratus Computer, Incorporated

Customer Service Documentation Department

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Preface

The *PA-8500 Continuum Series 400 Technical Service Guide* contains technical information that pertains to the servicing of Continuum 400 Series systems in accordance with Stratus servicing policies. It is designed for use by trained technical service personnel who are certified to remove and replace system components defined as field replaceable units (FRUs) and distributor replaceable units (DRUs).

This manual should be used in conjunction with the *??: Operation and Maintenance Guide (R601X)* written for customers who replace customer replaceable units (CRUs).

The *PA-8500 Continuum Series 400 Technical Service Guide* is comprised of the following sections:

- Introduction
- Operating and Software Maintenance Procedures
- Fault Isolation
- Hardware Removal and Replacement Procedures
- Theory of Operation
- Part Numbers
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1. Introduction

This section describes the requirements, components, configurations, and upgrade options for Stratus PA-8500 Continuum Series 400 systems. It covers the following topics:

- Overview
- Operating system requirements
- Hardware components
- System configurations
- System specifications

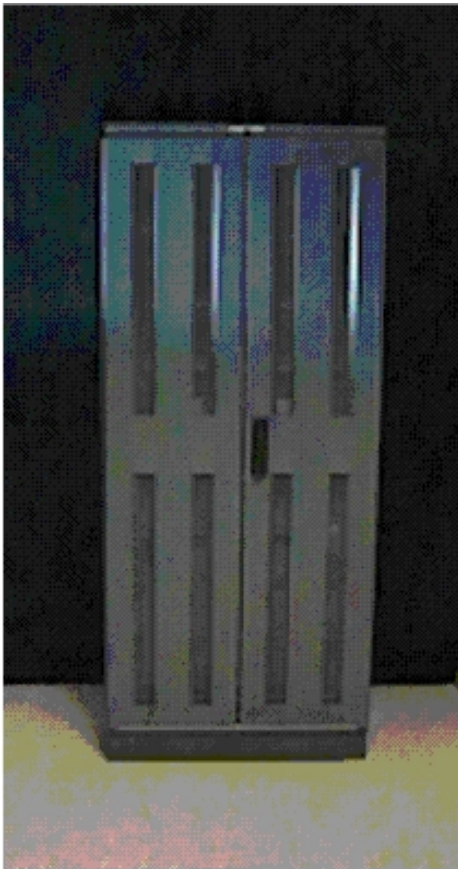
1.1 Overview

PA-8500 Continuum Series 400 systems combine the Hewlett Packard PA-RISC PA-8500 microprocessor with Stratus continuously available hardware. The microprocessor is available in uni or twin processor designs running at 360 MHz with 1.5 MB of L1 on-chip memory cache. The I/O section is based on the PCI (Peripheral Component Interconnect) I/O bus and uses standard commodity PCI cards.

The system is available in AC only. Both domestic and international versions are available, each with appropriate input voltage ranges.

Figure 1-1 shows a typical system.

Figure 1-1. PA-8500 Continuum Series 400 System



1.2 Operating System Requirements

PA-8500 Continuum Series 400 systems are currently supported only by HP-UX (Minimum Release 11.00.01)

All software is source-code compatible with Continuum 600/1200 Series systems.

1.3 Hardware Components

The PA-8500 Continuum Series 400 system cabinet houses the following major assemblies in a tower arrangement:

- Suitcases (2)
- PCI subsystem
- Disk subsystem
- Power and control subsystem

An amber LED, labeled **CABINET FAULT**, is located at the top of the cabinet, front and rear. The system can accommodate either overhead or under-the-floor cabling. The top of the cabinet is an open rectangle that serves as the cable port. This opening also plays a significant role in cooling the system. The system base has a perforated cover to accommodate system cabling that comes from under the floor.

A card labeled **STATUS LIGHTS - CRU LEDS** is attached to the backplane access cover on the front of the cabinet. The card summarizes the meaning of status-LED states for the power supplies, alarm control units (ACUs), disk drives, and suitcases.

Figure 1-2 shows the components that are accessible from the front of the system cabinet. For a detailed description of system LEDs, refer to [Section 3](#).

Figure 1-2. PA-8500 Continuum Series 400 System Components (Front)

Another card labeled **STATUS LIGHTS - CRU LEDS** is located on the rear of the cabinet on the suitcase backplane cover. It summarizes the meaning of the PCI-card status-LED states.

Figure 1-3 shows the components that are accessible from the rear of the cabinet. For a detailed description of system LEDs, refer to [Section 3](#).

Figure 1-3. PA-8500 Continuum Series 400 System Components (Rear)

1.3.1 Suitcases

The two PA-8500 suitcases are identical. Each houses the following components:

- CPU-Memory motherboard (contains one or two CPU/cache modules, one to four memory modules, and the Console Controller module)
- Power supply
- Two cooling fans

For a detailed description of the suitcases, refer to [Section 5.1](#).

The following table lists model numbers and gives a brief description of the CPU-Memory motherboards (suitcases), memory module, and CPU/cache module supported in PA-8500 Continuum Series 400 systems.

NOTE: The hardware components shown in the following table are at the base minimum revisions approved for operation at the time of publication. For current revision requirements and complete revision history, refer to the [??](#).

Model	Marketing ID	Description
G262	P1874H-ST	Uni processor, 360 MHz, 1.5 MB cache
G272	P1884H-ST	Twin processor, 360 MHz, 2\1.5 MB cache

M715	M715-2	Memory module (0.5 GB)
M717	M717-2	Memory module (2 GB)

1.3.2 PCI Subsystem

The PCI subsystem consists of the following major components:

- PCI bus
- Two PCI card cages
- PCI bridge cards (one per card cage)
- PCI adapter cards (up to 14)

For a detailed description of the PCI subsystem and its functions, refer to [Section 5.2](#).

The following table lists the PCI adapters supported by HP-UX 11.00.01 on PA-8500 Continuum Series 400 systems.

Note: The PCI cards shown in the following table are based on information available at the time of publication. For current (and more detailed) PCI information refer to the [PCI/PMC Adapter Technical Reference](#). The document is also available in [PDF format](#).

Model	Description	Min. HP-UX Release	Notes
K138-10	PCI bridge card	11.00.01	
E525	PCMCIA flash card	11.00.01	
U403-01	4-port, 4-MB synchronous adapter (EIA530)	11.00.01	
U403-02	4-port, 4-MB synchronous adapter (V.36)	11.00.01	
U403-03	4-port, 4-MB synchronous adapter (X.21)	11.00.01	
U403-04	4-port, 4-MB synchronous adapter (V.35)	11.00.01	
U404	8-port 4-MB synchronous adapter (RS-232)	11.00.01	
U420	1-port T1/ISDN adapter	11.00.01	
U420E	1-port E1/ISDN adapter	11.00.01	
U450	8-port asynchronous adapter	11.00.01	
U501	Fast wide single-ended SCSI adapter (1 external/2 internal ports)	11.00.01	
U502	Differential SCSI adapter		Post GA
U503	Differential SCSI adapter for EMC Symmetrix		Post GA
U512	2-port ethernet adapter (10/100 Mbps)	11.00.01	
U513	1-port ethernet adapter (10/100 Mbps)	11.00.01	
U520	1-port token ring adapter (4/16 Mbps)	11.00.01	

U530	FDDI adapter	11.00.01
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1.3.3 Disk/Tape Subsystem

The disk subsystem consists of two highly integrated, modular disk enclosures, each of which houses up to seven 3.5" SCSI disk drives. The drives are duplexed (top to bottom) for fault tolerance. Each disk enclosure can also house two power supply modules, three cooling fans, an SES (SCSI Enclosure Services) module, a SE-SE (single-ended to single-ended) I/O repeater module, and a terminator module. The seven disks and two power supplies are front mounted; all other modules plug in from the rear.

For a detailed description of the disk subsystem, refer to [Section 5.3](#).

The following table lists the disk and tape drives supported on PA-8500 Continuum Series 400 systems..

Note: The disk and tape drives shown in the following table are based on information available at the time of publication. For current (and more detailed) disk information refer to the [Continuum Disk Drives Technical Reference](#). The document is also available in [PDF format](#). For more information on DDS DAT tape drives, refer to the [DDS DAT Tape Drive Technical Reference](#). The document is also available in [PDF format](#).

Model/Marketing ID	Description	Min. HP-UX Release
D841	9-GB 3.5", 10,000 rpm, SCSI disk drive	11.00.01
D842	18-GB 3.5", 10,000 rpm, SCSI disk drive	11.00.01
D859	40x CD-ROM drive	11.00.01
T804	1.2-GB, QIC cartridge	11.00.01
T805	12-GB, DDS-3 DAT tape drive (1 cartridge)	11.00.01
T806	72-GB, DDS-3 DAT tape drive (6-cartridge autoloader)	11.00.01
C419	RSN modem	11.00.01
V105	ASCII console terminal emulating a VT320	11.00.01

1.3.4 Power Subsystem

The power subsystem consists of an AC front end unit (tray 1) and a power shelf (tray 2). Both are located in the upper section of the cabinet.

Tray 1 converts AC power into 48 VDC power. It supplies the suitcases, disks, and tray 2 with 48 VDC power. Tray 1 contains the following components:

- 2 AC-to-DC rectifiers (redundant, hot swappable, interchangeable)
- 2 Circuit breakers
- 2 AC input power connectors

- Backplane

Tray 2 supplies the power for the alarm control unit and PCI cards. It contains the following components:

- Interface backplane
- 2 PCI power supplies with internal fans (forced convection)
- 2 Alarm control units (ACUs)
- 2 Circuit breakers

For a detailed description of the power and control subsystem, refer to [Section 5.4](#).

1.4 System Configurations

The hardware configuration requirements and restrictions for the various PA-8500 Continuum Series 400 models are shown in the following table.

NOTE: The configurations shown in the following table are based on information available at the time of publication. For current (and more detailed) configuration information refer to the *Stratus Configuration Specification Document No. XXXXXX*. The document is available in Word or PDF format.

Component	Model 419	Model 429
Suitcase (CPU-Memory Board)	G262	G272
CPU module (360 MHz PA-8500)	Uni	Twin
No. logical CPUs	1	2
Number of M715 memory modules (0.5 GB) per system	Min. = 2 Max. = 8	Min. = 2 Max. = 8
Number of M717 memory modules (2 GB) per system	Min. = 2 Max. = 8	Min. = 2 Max. = 8
Duplexed memory	Min. = 0.5 GB Max. = 4 GB*	Min. = 0.5 GB Max. = 4 GB*
Number of disk drives	Min. = 2 Max. = 14	Min. = 2 Max. = 14
Maximum duplexed disk storage (using 9-GB drives)	63 GB	63 GB
Maximum duplexed disk storage (using 18-GB drives)	126 GB	126 GB
Max. number of tape drives	4	4

* 3.75 GB actually used by HP-UX.

1.5 System Specifications

1.5.1 Physical

	System	Suitcase	Shipping Container
Height	182.9 cm (72 in)	47 cm (18.5 in)	202 cm (79.5 in)
Width	60.0 cm (23.6 in)	22 cm (8.5 in)	86.4 cm (34 in)
Depth	60.0 cm (23.6 in)	47 cm (18.5 in)	96.5 cm (38 in)

Weight	318.2 kg (701 lb) max. configuration	28.8 kg (63.5 lb)	34 kg (75 lb)
Service Clearance	Minimum 0.6 m (2 ft) in front and rear of cabinet. Minimum 0.5 m (1.5 ft) of unobstructed area above the cable trough on top of cabinet.		

1.5.2 Environmental

Operating Temperature:	
-200 to 6000 ft	4.5° to 40° C (40° to 104° F)
6000 to 8000 ft	4.5° to 35° C (40° to 95° F)
8000 to 10,000 ft	4.5° to 30° C (40° to 86°F)
Max. rate of temp. change:	12°/hr C (21.6 °/hr F)
Relative humidity:	10% to 80% non-condensing
Maximum heat dissipation:	9200 Btu/hr (2700 W)
Electrostatic Discharge:	
Air discharge:	8 kv (max)
Direct-contact discharge	6 kv (max)
Dust:	To prevent dust buildup, operate system where minimal dust is generated. Use of air filters throughout the system is also an option.
Acoustical Noise:	
Normal Conditions	55 dbA (max)
High temperature or fault condition	61 dbA (max)

1.5.3 Electrical

	Minimum	Maximum
AC input voltage	180 VAC	264 VAC
AC input frequency	47 Hz	63 HZ
AC current available per line cord		20 Amps
Source power factor @ Po>25%, Vin=nominal	0.80	1.0
Steady state: AC input KVA AC input Watts	N/A	2.4 KVA 2200 Watts

2. Operating and Maintenance Procedures

This chapter explains the basic operating procedures used for PA-8500 Continuum 400 Series system operation and maintenance under the HP-UX 11.00.01 operating system. Topics covered include the following:

- Starting the system
- Shutting down the system
- Rebooting the system
- Configuring the console terminal
- Console command menu
- System component locations
- Maintenance procedures

For a more complete description of the procedures covered in this section refer to the manual *HP-UX Operating System: Fault Tolerant System Administration* (R1004H-04-ST).

There is no physical control panel on Continuum 400 Series systems. Operating commands are entered at the system console which is connected to the system via the Console Controller module in the suitcase.

2.1 Starting the System

When the system is powered up, it displays the model, memory size, board revision, and other information. It then displays the following message on the system console and waits approximately 10 seconds before proceeding with an automatic boot process in order to provide the option of performing a manual boot:

Hit any key to enter manual boot mode, else wait for auto boot.

The bootstrap process begins upon completion of system power up (and at certain other times, such as after a **reset_bus** console command).

Boot Start Up - After the processor is RESET, **CPU PROM** (the Stratus PROM code firmware) performs a self-test and initializes the processor. If **autoboot** is enabled on the system, **CPU PROM** loads and transfers control to **lynx** (the Stratus HP-UX primary bootloader), which loads and transfers control to **isl** (the secondary bootloader). If **autoboot** is not enabled, **CPU PROM** provides an interactive interface with the **PROM:** prompt and the system waits for you to enter the following command: **boot location** where *location* is the location of the boot device (flash card). When the **boot** command is executed, the **CPU PROM** loads and transfers control to **lynx** (the Stratus HP-UX primary bootloader).

Primary Bootloader - The **lynx** primary bootloader provides an interactive interface with the **lynx\$** prompt and the system waits for you to enter the following command: **boot [options]** where *options* are

not required. The primary bootloader reads the **CONF** file on the flash card for instructions on system configuration during the bootstrap process before issuing the **lynx\$** prompt, but specific commands entered at the primary bootloader **lynx\$** prompt take precedence over the instructions in the **CONF** file. When the **boot** command is executed, the **lynx** primary bootloader loads and transfers control to **isl** (the secondary bootloader).

Secondary Bootloader - If you do not press a key during the secondary bootloader process initiation, the boot process continues without any prompting and **isl** automatically downloads the HP-UX kernel object file from an HP-UX file system and transfers control to the loaded kernel image. If you press a key during the secondary bootloader process initiation, **isl** provides an interactive interface with the **ISL>** prompt and the system waits for you to enter the following command: **hpux boot**. Then, **isl** completes the boot process and various messages are displayed until the login prompt is displayed.

2.1.1 Automatic System Startup

If the firmware detects no keyboard activity after the message 'Hit any key to enter manual boot mode, else wait for auto boot' is displayed, it begins the **autoboot** sequence by loading and transferring control to the **bootloader**. Informational messages are then displayed on the console.

Next, the **bootloader** reads the **boot loader** configuration file for boot parameters and displays messages that describe the operation being performed, the hardware path of the root disk, the path name of the kernel, the TEXT size, the DATA size, the BSS size, and start address of the load image. For example:

```
Booting disc(14/0/0.0.0;0)/stand/vmunix
4233148+409600+465536 start 0x270f68
```

Finally, the **bootloader** passes control to the loaded image. The loaded image displays numerous configuration and status messages. The bootup process ends when you see the login prompt on the console.

2.1.2 Manual System Startup

Perform the following procedure to boot the system manually.

NOTE: The system can be booted from the flash card in either PCI card cage 2 or 3.

1. Power on the system and press any key during the 10-second interval allowed by the boot PROM when the following message appears:

```
Hit any key to enter manual boot mode, else wait for
autoboot
```

2. When the PROM: prompt appears, enter the following command to boot the system using the flash card in card cage 2.

boot 2

NOTE: To boot from the flash card in card cage 3, enter **boot 3** instead.

Once the system finds the boot device, it displays the boot hardware path, transfers control to the primary **bootloader**, and displays the **bootloader** prompt `lynx$`.

NOTE: To get a complete list of the bootloader commands, enter **help** at the `lynx$` prompt.

As part of the boot process, the primary bootloader reads the **CONF** file (from the LIF volume) for configuration information. However, entries at the `lynx$` prompt have precedence over entries in the **CONF** file.

3. When **boot** command is entered at the `lynx$` prompt, the boot process continues, control transfers to the secondary bootloader (**isl**) and the following prompt appears:

`ISL>`

At this point you can enter various secondary bootloader (**isl**) commands. However, do not change the boot device.

5. Enter the **hpux boot** command to have the boot process continue without further prompting. Various messages are displayed until the login prompt appears, at which point the boot process is complete.

System parameter information such as the date and time can be modified using **/sbin/set_parms**. To enter the appropriate **set_parms** dialog screen to manually add or modify information after booting, log in as **superuser** and specify the following command:

set_parms option

where *option* is the system parameter you want to modify. For more information on this command, see the manual *HP-UX Operating System: Fault Tolerant System Administration* (R1004H-03).

2.2 Shutting Down the System

This section describes how to perform an orderly shutdown of the system.

1. Login as **root**.
2. Change to the root directory and enter the following command:

/usr/sbin/shutdown

This command shuts down to single-user state allowing the default 60 second grace period.

CAUTION: If the system is on a network, do not run **shutdown** from a

remote system. You will be logged out and control will be returned to the system console.

3. Before changing to single-user state, you will be asked if you want to send a message to inform users how much time they have to end their activities and when to log off.

If you want to send a message, enter **y**.

4. Type the message (on one or more separate lines) announcing the shutdown. End the message by pressing the **Return** key and then pressing the **CTRL** and **D** keys simultaneously.

Example:

```
The system will shut down in 5 minutes.  
Please log off.  
<CTRL-D>
```

5. To bring the system to a complete stop, enter the following command:

```
reboot -h
```

Watch the messages during the process and note actions.

The system is shut down completely when the console displays the message **halted**.

2.3 Rebooting the System

This section describes how to reboot the system.

1. Login as **root**.

2. Check to see if any users are on the system by entering the **who -H** command.

3. If there are users on the system, enter the **wall** command followed by a message (on one or more separate lines) announcing the shutdown. End the message by pressing the **CTRL** and **D** keys simultaneously.

Example:

```
wall  
The system will be shut down in 5 minutes.  
Please log off.  
<CTRL-D>
```

4. If the system is in single-user state, enter the following command:

reboot

Otherwise, enter the following:

shutdown -r

2.4 Console Command Menu

The Console Controller supports a command menu that can be used to issue key machine management commands to the system from the system console. It can reboot or execute other commands on a nonfunctioning system.

To access the console command menu from a V105 console using an ANSI keyboard, press the **F5** key. To access the console command menu from a V105 using a PC keyboard, press the **CTRL** and **PAUSE** keys simultaneously. Other terminals generally use the **Break** key alone to enter command mode. This puts the console into command mode and displays the following menu:

```
help.....displays command list.
shutdown.....begin orderly system shutdown.
restart_cpu....force CPU into kernel dump/debug mode.
reset_bus.....send reset to system.
hpmc_reset.....send HPMC to cpus.
history.....display switch closure history.
quit, q.....exit the front panel command loop.
. ....display firmware version.
```

The following describes the actions of each command:

help - Displays the menu list on the screen.

shutdown - Initiates an immediate orderly system shutdown.

restart_cpu - Issues a broadcast interrupt (level 7) to all CPU boards in the system. Generates a system dump.

reset_bus - If there is a nonbroken CPU/memory board in the system, this command issues a "warm" reset (that is, save current registers) to all boards on the main system bus. Immediately kills all system activities and reboots the system. **CAUTION:** Do not use this command on PA-8500 systems if you want a system dump; use the **hpmc_reset** command instead.

hpmc_reset - Issues a high priority machine check (HPMC) to all CPUs on all CPU-memory boards in the system. This command first flushes the caches to preserve dump information and then (based on an internal flag value) either invokes a "warm" reset (that is, reboots the system, saving current memory and registers) or simply returns to the HP-UX operating system.

history - Displays a list of the most recently entered console commands.

quit, q - Exits the console command menu and returns the console to its normal mode. (If

nothing is entered for 20 seconds, the system automatically exits the console command menu.)

- - Displays the current firmware version number.

2.5 Configuring the Console Terminal

Perform the following procedure to configure the console terminal.

1. Consult the terminal manual for specific configuration information or instructions.
2. Execute the following commands at the console or put them into the root **/ .profile** file.

```
TERM=terminal_type
export TERM
tput init
tabs
```

where **TERM** establishes the terminal type. For example, enter **TERM=vt320** for a V105 terminal running in VT320 emulation mode. The **tput** command initializes the terminal, and the **tabs** command sets tabs.

2.6 System Component Locations

Each hardware component configured on a HP-UX system can be identified by its hardware path. A hardware path specifies the address of the hardware components leading to a device. It consists of a numerical string of hardware addresses, notated sequentially from the bus address to the device address. Typically, the initial number is appended by a slash (/) to represent a bus converter or adapter and subsequent numbers are separated by slashes or dots (.).

2.6.1 Physical Hardware Configuration

The system bus connects the CPU-Memory boards (and corresponding suitcases) with the PCI bridge (PCIB) cards (and associated cardcages). The CPU-Memory board (and corresponding suitcase) numbers are 0 and 1. The PCIB card (and corresponding cardcage) numbers are 2 and 3.

2.6.1.1 CPU-Memory Bus Hardware Paths

The physical CPU-Memory board hardware path addressing convention is as follows:

- First-level address identifies the bus. The system bus is 0 and the console controller (RECC) bus is 1.
- Second-level address identifies either the CPU-Memory board or the console controller. In either case, the values for duplexed boards are 0 and 1.
- Third-level address identifies the component on the CPU-Memory board (0 for the CPU, 1 for the memory module)

Examples:

Bus	CPU-Memory Board or Console Controller	Component	Hardware Path of Component
System (0)	CPU-Memory board	CPU (processor)	0/0/0
System (0)	CPU-Memory board	CPU (processor)	0/1/0
System (0)	CPU-Memory board	Memory Module	0/0/1
System (0)	CPU-Memory board	Memory Module	0/1/1
RECC (1)	Console Controller	Console Controller	1/0
RECC (1)	Console Controller	Console Controller	1/1

2.6.1.2 PCI Bus Hardware Paths

The PCI bus hardware path addressing convention is as follows:

- First-level address identifies the main system bus (0).
- Second-level address identifies the PCIB (and corresponding cardcage) numbers (2 or 3).
- Third-level address identifies the slot in which a PCI card resides in the cardcage (0-7).

Examples:

Cardcage	PCI Card Slot #	PCI Card Hardware Path
2	0-7	0/2/7
3	0-7	0/3/7

- Fourth-level address identifies PCI ports (such as a SCSI port on a U501 card or a LAN port on a U513 card).

Examples:

Cardcage	SCSI Adapter slot #	SCSI Adapter Hardware Paths
2	7	0/2/7/0, 0/2/7/1, 0/2/7/2
3	7	0/3/7/0, 0/3/7/1, 0/3/7/2

A PCI-to-PCI bridge in cardcage 2 could have address 0/2/3/0. A PCMCIA bridge in cardcage 3 could have address 0/3/0/0.

- Fifth-level address is device specific. For example, a four-port LAN adapter would have four

fifth-level addresses, one for each port.

Example:

Cardcage	LAN Adapter Slot #	LAN Adapter Hardware Paths
2	3	0/2/3/0/4, 0/2/3/0/5, 0/2/3/0/6, 0/2/3/0/7

2.6.2 Logical Hardware Configuration

There are four major logical components on the system bus:

- Logical cabinet
- Logical LAN manager
- Logical SCSI manager (LSM)
- Logical CPU-Memory board.

2.6.2.1 Logical Cabinet Hardware Path

Cabinet components—such as ACU units, fans, and power supplies—do not have true physical addresses. However, they are treated as pseudo devices and given logical addresses for reporting purposes. The logical cabinet addressing convention is as follows:

- The first-level address, 12, is the logical cabinet (CAB).
- The second-level address identifies the specific cabinet number. For a PA-8500 Continuum Series 400, this is always 0.
- The third-level address identifies individual cabinet components. (The number sequence is arbitrary.)

For example, an ACU could have a logical cabinet hardware path of 12/0/1.

2.6.2.2 Logical LAN Manager Hardware Paths

- The first-level address, 13, is the LAN manager (LNM).
- The second-level address is always 0.
- The third-level address identifies a specific adapter (port).

For example, a system with three logical ethernet (LAN) ports would have the following hardware paths: 13/0/0, 13/0/1, and 13/0/2.

2.6.2.3 Logical SCSI Manager Hardware Paths

The logical SCSI manager has two primary purposes: to serve as a generalized host bus adapter driver front-end and to implement the concept of a logical SCSI bus. A logical SCSI bus (LSB) is one that is

mapped independently from the actual hardware addresses. A physical SCSI bus can have one or two initiators located anywhere in the system, but the logical SCSI manager allows you to target each SCSI bus by its logical SCSI address without regard to its physical location. By using a logical SCSI manager, you can configure (and reconfigure) dual-initiated SCSI buses across any SCSI controllers in the system. The LSM also provides transparent failover between partnered physical controllers (which are connected in a dual-initiated mode).

The LSM addressing convention is as follows:

- First-level address identifies the LSM number (always 14).
- Second-level address describes a transparent slot (always 0).
- Third-level address is the LSB number (0-15).
- Fourth-level address is the bus address associated with the device (0-5, 14). This is the SCSI target ID.
- Fifth-level address is the logical unit number (LUN) of the device (always 0).

Examples for disk drives:

NOTE: The 7th drive slot in the enclosure is labeled 14, since 14 is the SCSI ID of that drive.

LSB	Disk Drive Slot #s in Disk Enclosure	Disk Drive LSM Hardware Paths
0	0, 1, 2, 3, 4, 5, 14	14/0/0.0.0, 14/0/0.1.0, 14/0/0.2.0, 14/0/0.3.0, 14/0/0.4.0, 14/0/0.5.0, 14/0/0.14.0
1	0, 1, 2, 3, 4, 5, 14	14/0/1.0.0, 14/0/1.1.0, 14/0/1.2.0, 14/0/1.3.0, 14/0/1.4.0, 14/0/1.5.0, 14/0/1.14.0

Four LSBs are defined off the U501 SCSI controllers: dual-initiator buses 0 and 1 for disk drives and single-initiator buses 2 and 3 for tape/CD-ROM drives. Dual-initiator buses are connected to two SCSI controllers (primary and secondary) to provide fault-tolerant protection.

The following table shows the LSM hardware paths and SCSI primary/secondary controller hardware paths that are associated with each of the four LSBs.

LSB #	LSM Hardware Path	Active SCSI Port Hardware Path	Standby SCSI Port Hardware Path
0 (dual-initiator)	14/0/0	0/2/7/1	0/3/7/1
1 (dual-initiator)	14/0/1	0/2/7/2	0/3/7/2
2 (single-initiator)	14/0/2	0/2/7/0	none
3 (single-initiator)	14/0/3	0/3/7/0	none

2.6.2.4 Logical CPU-Memory Board Addresses

The logical CPU-Memory board is an abstraction of the physical CPU-Memory board addressing scheme.

The logical CPU-Memory board addressing convention is as follows:

- First-level address identifies the logical CPU-Memory board number (always 15).
- Second-level address identifies the resource type (0 for CPUs, 1 for memory, and 2 for the Console Controller).
- Third-level address identifies individual resources: CPU is 0 (for a uniprocessor or first twin processor) or 1 (for second twin processor), memory is always 0 (memory is a single resource), and the Console Controller has three resources (0-2): Console port is 0, RSN port is 1, and auxiliary port is 2.

Examples:

CPU-Memory Board Component	Component Hardware Path
Uniprocessor	15/0/0
Twin processors	15/0/0 and 15/0/1
Memory	15/1/0
Console Controller console port	15/2/0
Console Controller RSN port (tty1)	15/2/1
Console Controller auxiliary port (tty2)	15/2/2

2.6.3 Listing of System Component Locations

To view a typical listing of the system components, enter the following command:

```
/sbin/ftsmaint ls |pg
```

The display is shown in the following format.

Sample Screen:

```
>Modelx H/W Path      Description          State Serial#    PRev Status  FCode FCT
>
>=====
>
>-
>-          0          GBUS Nexus          CLAIM -          -      Online -      0
>g26200 0/0          PMERC Nexus          CLAIM 10300        9.0  Online -      5
>-          0/0/0        CPU Adapter          CLAIM -          -      Online -      0
>m71500 0/0/1        MEM Adapter          CLAIM -          -      Online -      0
>g26200 0/1          PMERC Nexus          CLAIM 10323        9.0  Online -      0
>-          0/1/0        CPU Adapter          CLAIM -          -      Online -      0
>m71500 0/1/1        MEM Adapter          CLAIM -          -      Online -      0
>k13800 0/2          PCI Nexus            CLAIM 12091        -      Online -      1
>-          0/2/0        SLOT Interface       CLAIM -          -      Online -      0
>-          0/2/0/0      PCMCIA Bridge        CLAIM -          -      Online -      0
>e52500 0/2/0/0.0     FLASH Adapter        CLAIM -          -      Online -      0
>-          0/2/1        SLOT Interface       CLAIM -          -      Online -      0
```

```

>-      0/2/1/0      11ABF002      UNCLA -      -      Offline -      0
>-      0/2/2      SLOT Interface      CLAIM -      -      Online -      0
>-      0/2/2/0      PCI-PCI Bridge      CLAIM -      -      Online -      0
>u51200 0/2/2/0/6      LAN Adapter      CLAIM -      1      Offline -      0
>u51200 0/2/2/0/7      LAN Adapter      CLAIM -      1      Offline -      0
>-      0/2/3      SLOT Interface      CLAIM -      -      Online -      0
>u40300 0/2/6/0      X25 4-port Adapter(4 CLAIM -      -      Online -      0
>-      0/2/7      SLOT Interface      CLAIM -      -      Online -      0
>u50100 0/2/7/0      SCSI Adapter W/SE      CLAIM 42-012157 0ST5 Online -      0
>u50100 0/2/7/1      SCSI Adapter W/SE      CLAIM 42-012157 0ST5 Online -      0
>u50100 0/2/7/2      SCSI Adapter W/SE      CLAIM 42-012157 0ST5 Online -      0
>k13800 0/3      PCI Nexus      CLAIM 12129      -      Online -      1
>-      0/3/0      SLOT Interface      CLAIM -      -      Online -      0
>-      0/3/0/0      PCMCIA Bridge      CLAIM -      -      Online -      0
>e52500 0/3/0/0.0      FLASH Adapter      CLAIM -      -      Online -      0
>-      0/3/1      SLOT Interface      CLAIM -      -      Online -      0
>-      0/3/1/0      11ABF002      UNCLA -      -      Offline -      0
>-      0/3/2      SLOT Interface      CLAIM -      -      Online -      0
>-      0/3/2/0      PCI-PCI Bridge      CLAIM -      -      Online -      0
>u51200 0/3/2/0/6      LAN Adapter      CLAIM -      1      Offline -      0
>u51200 0/3/2/0/7      LAN Adapter      CLAIM -      1      Offline -      0
>-      0/3/5      SLOT Interface      CLAIM -      -      Online -      0
>u50100 0/3/7/0      SCSI Adapter W/SE      CLAIM 42-012081 0ST5 Online -      0
>u50100 0/3/7/1      SCSI Adapter W/SE      CLAIM 42-012081 0ST5 Online -      0
>u50100 0/3/7/2      SCSI Adapter W/SE      CLAIM 42-012081 0ST5 Online -      0
>-      1      RECCBUS Nexus      CLAIM -      -      Online -      0
>e59400 1/0      RECC Adapter      CLAIM -      18.0 Online -      0
>e59400 1/1      RECC Adapter      CLAIM -      18.0 Online -      0
>-      12      CAB Nexus      CLAIM -      -      Online -      0
>-      13      LNM Nexus      CLAIM -      -      Online -      0
>-      13/0/0      LAN Adapter      CLAIM -      0      Online -      0
>-      14      LSM Nexus      CLAIM -      -      Online -      0
>-      14/0/0      LSM Adapter      CLAIM -      -      Online -      0
>-      14/0/0.0      CLAIM -      -      Online -      0
>d84100 14/0/0.0.0      SEAGATE ST39103LC      CLAIM -      -      Online -      0
>-      14/0/1      LSM Adapter      CLAIM -      -      Online -      0
>-      14/0/1.0      CLAIM -      -      Online -      0
>d84100 14/0/1.0.0      SEAGATE ST39103LC      CLAIM -      -      Online -      0
>-      14/0/2      LSM Adapter      CLAIM -      -      Online -      0
>-      14/0/2.4      CLAIM -      -      Online -      0
>d85900 14/0/2.4.0      SONY      CD-ROM CDU-7 CLAIM -      -      Online -      0
>-      14/0/3      LSM Adapter      CLAIM -      -      Online -      0
>-      15      LMERC Nexus      CLAIM -      -      Online -      0
>:      15/0/0      Processor      CLAIM -      -      Online -      0
>-      15/1/0      Memory      CLAIM -      -      Online -      0
>-      15/2/0      console      CLAIM -      -      Online -      0
>-      15/2/1      tty1      CLAIM -      -      Online -      0
>-      15/2/2      tty2      CLAIM -      -      Online -      0

```

2.6.3.1 Software State Information

The system creates a node for each hardware device that is either installed or listed in the **/stand/ioconfig** file.

The **State** field in the **ftsmaint ls** display can show a hardware component to be in any one of the software states shown in the following table.

State	Meaning
UNCLAIMED	Initialization state, or hardware exists, and no software is associated with the node.
CLAIMED	The driver recognizes the device.
ERROR	The device is recognized, but it is in an error state.
NO_HW	The device at this hardware path is no longer responding.
SCAN	Transitional state that indicates the device is locked. A device is temporarily put in the SCAN state when it is being scanned by the ioscan or ftsmaint utilities.

The software state of a hardware component can change. For example, a component is initially created in the UNCLAIMED state when it is detected at boot time. The component moves to the CLAIMED state when it is recognized and claimed by the appropriate driver. The transitions between the various software states are controlled by the **ioscan** and **ftsmaint** utilities.

2.6.3.2 Hardware Status Information

In addition to a software state, each hardware component has a particular hardware status. The **Status** field in the **ftsmaint ls** display can have any of the values shown in the following table.

Status	Meaning
Online	The device is actively working.
Online Standby	The device is not logically active, but it is operational. Using the ftsmaint switch or ftsmaint sync command can be used to change the device status to Online.
Duplexed	The status is appended to the Online status to indicate that the device is fully duplexed.
Duplexing	The status is appended to the Claimed online or Claimed Offline status to indicate that the device is in the process of duplexing. This transient status is displayed after the ftsmaint sync or ftsmaint enable command has been used on the CPU-Memory board.
Offline	The device is not functional or not being used.
Burning PROM Offline Standby	The ftsmaint burnprom command is in progress on the device. The suitcase stays in offline standby when burning PROM.

The status of a hardware component can change. For example, a component could go from Online to Offline because of a hardware or software error.

2.6.3.3 Fault Codes

The fault tolerant services return fault codes when certain events occur. Fault codes are displayed by the **ftsmaint ls** command in the FCode field and by the **ftsmaint ls -l** command in the Fault Code field. The following table lists and describes the fault codes.

ls Format	ls -l Format	Explanation
DSKFAN	Disk Fan Faulted/Missing	The disk fan either faulted or is missing.
HARD	Hard Error	The driver reported a hard error. A hard error occurs when a hardware fault occurs that the operating system is unable to correct. Look at the sys log for related error messages.
HWFLT	Hardware Fault	The hardware device reported a fault. Look at the sys log for related error messages.
IS	In Service	The CRU/FRU is in service.
MISS	Missing replaceable unit	No hardware was found. The hardware component has been removed from the system. Look at the sys log for related error messages.
MTBF	Below MTBF Threshold	The CRU/FRU's rate of transient and hard failures became too great.
PCIOPN	PCI Card Bay Door Open	The PCI cardcage door is open.
NOPWR	No power	The CRU/FRU lost power.
OVERRD	Cabinet Fan Speed Override Active	The fan override (setting fans to full power from normal) was activated.
SOFT	Soft Error	The driver reported a transient error. A transient error occurs when a hardware fault is detected, but the problem is corrected by the operating system. Look at the sys log for related error messages.
USER	User Reported Error	A user issued an ftsmaint disable command to disable the hardware component.

2.6.4 Hardware Paths and Device Names

Device file names use the following convention:

/dev/type/c#t#d#

type indicates the device type; **c#**, **t#**, and **d#** correspond to the parts of the hardware path as follows:

c# corresponds to the instance number of the SCSI bus on which the disk is connected.

t# corresponds to the SCSI target ID.

d# corresponds to the logical unit number (LUN) - always 0.

Storage devices use the following conventions:

- For disk and CD-ROM devices, type is **dsk**.
- For tape devices, type is **rmt**, and the remaining numbers are the same as for disk and CD-ROM devices. Tape device file names can include additional letters at the end that specify the operational characteristics of the device. (The **/dev/rmt** directory also includes standard tape device files, for example 0m and 0mb, that do not identify a specific device as part of the file name.)
- For flash cards, type is **rflash**, **c#** is the instance number of the flash card (either 2 or 3), and **t#** and **d#** are always zero (0). Flash cards also use the form **c#a#d#** instead of **c#t#d#**. Flash cards are not SCSI devices and use physical, not logical, hardware paths.

The following table lists the hardware paths and device names for the disk drives. Disks are numbered from right to left, as viewed from the front of the system.

NOTE: The 7th drive slot in the enclosure is labeled 14, since 14 is the SCSI ID of that drive.

Disk Drive Slot Location	Hardware Path (Enclosure 0)	Device Name (Enclosure 0)	Hardware Path (Enclosure 1)	Device Name (Enclosure 1)
0	14/0/0.0.0	/dev/dsk/c0t0d0	14/0/1.0.0	/dev/dsk/c1t0d0
1	14/0/0.1.0	/dev/dsk/c0t1d0	14/0/1.1.0	/dev/dsk/c1t1d0
2	14/0/0.2.0	/dev/dsk/c0t2d0	14/0/1.2.0	/dev/dsk/c1t2d0
3	14/0/0.3.0	/dev/dsk/c0t3d0	14/0/1.3.0	/dev/dsk/c1t3d0
4	14/0/0.4.0	/dev/dsk/c0t4d0	14/0/1.4.0	/dev/dsk/c1t4d0
5	14/0/0.5.0	/dev/dsk/c0t5d0	14/0/1.5.0	/dev/dsk/c1t5d0
14	14/0/0.14.0	/dev/dsk/c0t14d0	14/0/1.14.0	/dev/dsk/c1t14d0

For flash cards, the second-level address in the hardware path (the PCI bus number, either 2 or 3) corresponds to the **c#** part of the device name. The other parts of the device name are always 0.

Example:

Cardcage	Flashcard Hardware Path	Device Name
2	0/2/0/0.0	/dev/rflash/c2a0d0
3	0/3/0/0.0	/dev/rflash/c3a0d0

2.7 Maintenance Procedures

When the system boots up, the operating system checks each hardware path to determine whether a CRU/FRU component is present and to record the model number of each component it finds. Each component is added automatically to that hardware path, and component maintenance is initiated. Maintenance performed by the operating system includes the following:

- Attempting recovery if a component suffers transient failures
- Responding to maintenance commands
- Making component resources available to the operating system
- Logging changes in component status
- Supplying component status
- Supplying component state on demand

During normal operation, the operating system periodically checks each hardware path. If a component is not operating, is missing, or is the wrong model number for that hardware path's definition, messages are issued to the system log and console.

Replacing or deleting some components requires only that the unit be inserted or removed from the system. Other removal/replacement procedures require that software commands be entered. The primary hardware maintenance utility is the **ftsmaint** command which is used for many tasks, including the following:

- Determining hardware paths
- Displaying software state information
- Removing and replacing hardware components
- Displaying and managing MTBF (mean time between failures) statistics
- Burning PROM code

This section provides a set of software procedures used to maintain the system, including commands to prepare a unit for removal and verifying that the component is operating after replacement. Since most hardware components in a HP-UX Continuum 400 Series system are customer replaceable, the physical removal/replacement procedures for CRUs are not described in this manual. Refer to the *HP-UX Operating System: Continuum Series 400 Operation and Maintenance Guide Release 1.0* (R025H-01-ST) for detailed information on removing and replacing CRUs. For tape drive maintenance, refer to the *Continuum Series 400 Tape Drive Operation Guide* (R719-01-ST).

2.7.1 Removal and Replacement

2.7.1.1 Preparing to Remove a Suitcase

A suitcase is hot pluggable (can be removed without entering any commands) if its red LED is on and the yellow and green LEDs are off. However, you should verify its location as follows:

1. Note the number (either 0 or 1) on the front label of the failed suitcase.
2. Enter the following command to verify the state and status of the suitcase:

```
/sbin/ftsmaint ls hw_path
```

where *hw_path* is the hardware path of the suitcase (0/0 or 0/1).

The information in the **State** and **Status** fields of the display will show information on the failed suitcase.

2.7.1.2 Verifying Suitcase Operation

After the replacement suitcase is installed, the system automatically tests it and duplexes it with the other suitcase. When testing is complete, the red LED will turn off and the green LED will illuminate. Perform the following to verify proper operation of the suitcase:

1. Enter the **/sbin/ftsmaint ls hw_path** command.

where *hw_path* is the hardware path of the suitcase (0/0 or 0/1).

2. Verify that the replacement suitcase is now operational by checking the **State** and **Status** fields. While the suitcase is coming online, its state should be listed as **Claimed** and the status should be listed as **Offline Duplexing**. When duplexing is complete, its **State** field should be listed as **CLAIMED** and the **Status** field should be listed as **Online Duplexed**.

3. Enter the following command to update the date to ensure that it is the same on both Console Controllers.

```
date mddHHMM[yyyy]
```

where **mm** specifies the month, **dd** is the day of the month, **HH** is the hour (24-hour system), **MM** is the minute, and **yyyy** is the year.

NOTE: All new or replacement boards come with the latest PROM code already installed. Therefore, it is not necessary to burn the PROM of any new hardware. However, if only one suitcase is replaced, it might be necessary to burn the PROM on the Console Controller in the "old" suitcase to match the Console Controller in the replacement suitcase. Burning the PROM code on the Console Controller is described in [Section 2.7.3.2](#).

2.7.1.3 Preparing to Remove a PCI Card

When an I/O cardcage is opened, its PCI bus is automatically powered down and all PCI cards housed within the cardcage are logically removed from the system. Before opening the cardcage, verify the location and state of the failed PCI card as follows:

1. Check the LEDs on the PCI cardcage slot where the PCI card is located.
2. If the red LED is on, enter the following command:

```
/sbin/ftsmaint ls
```

The information in the **State** and **Status** fields of the display will show information on the failed PCI card. The state will be **ERROR** and the status will be **Offline**.

3. Disable the PCI card by entering the following command:

```
/sbin/ftsmaint disable hw_path
```

where *hw_path* is the hardware path of the PCI card. (0/2/x or 0/3/x, where 2 or 3 is the cardcage and x is the slot number within the cardcage (0 - 7)).

2.7.1.4 Enabling a PCI Card and Verifying its Operation

After the replacement PCI card is installed and the cardcage door is closed, the system automatically tests and brings all the cards in that cardcage online.

1. Enable the new PCI card by entering the following command:

```
/sbin/ftsmaint enable hw_path
```

where *hw_path* is the hardware path of the PCI card (0/2/x or 0/3/x, where 2 or 3 is the cardcage and x is the slot number within the cardcage (0-7)).

2. When the PCI card comes online, its green LED (and all the other PCI card green LEDs in the cardcage) will be on. To further verify that the replacement PCI card is functioning properly, enter the following command:

```
/sbin/ftsmaint ls hw_path
```

3. Check the **State** and **Status** fields. The **State** field should be listed as **CLAIMED** and the **Status** field should be listed as **Online**.

2.7.1.5 Preparing to Remove a Flash Card

The flash card is hot pluggable (can be removed without entering any commands). However, you should verify its location as follows.

1. Enter the following command:

```
/sbin/ftsmaint ls
```

2. Determine the hardware path of the flash card to be removed (0/2/0/0.0 or 0/3/0/0.0).

The information in the **State** and **Status** fields of the display will show information on the failed flash card.

2.7.1.6 Verifying Flash Card Replacement

1. To verify proper operation of the flash card, enter the following command:

```
/sbin/ftsmaint ls hw_path
```

where *hw_path* is the hardware path of the flash card (0/2/0/0.0 or 0/3/0/0.0).

2. Check the **State** and **Status** fields. The **State** field should be listed as **CLAIMED** and the **Status** field should be listed as **Online**.

3. To write the current version of the **/stand** directory to the new flash card, refer to [Section 2.7.2.2](#).

2.7.1.7 Preparing to Remove a Disk Drive

Verify the location and status of the disk drive using the following procedure.

1. Determine the hardware path and path name of the disk to be replaced. Refer to [Section 2.6.4](#) for a complete listing of the hardware paths and device names of the disk drives.
2. Check the state of the disk drive to be replaced by entering the following command:

```
/sbin/ftsmaint ls hw_path
```

where *hw_path* is the hardware path of the disk drive to be replaced.

If the disk is being replaced because of a disk failure (**State** field is listed as **ERROR**) go to [Step 6](#). Otherwise, continue with Step 3.

3. Check to see if the disk being replaced is an online, mirrored physical volume (also called an LVM disk drive), or an online, non-mirrored LVM disk drive by using the following command:

```
/sbin/vgdisplay -v
```

The display is shown in the following format.

Sample Screen (partial):



4. Obtain a value for `volume_path` from the **`vgdisplay -v`** command. A `volume_path` in the above display is `/dev/vg00/lvo11`.

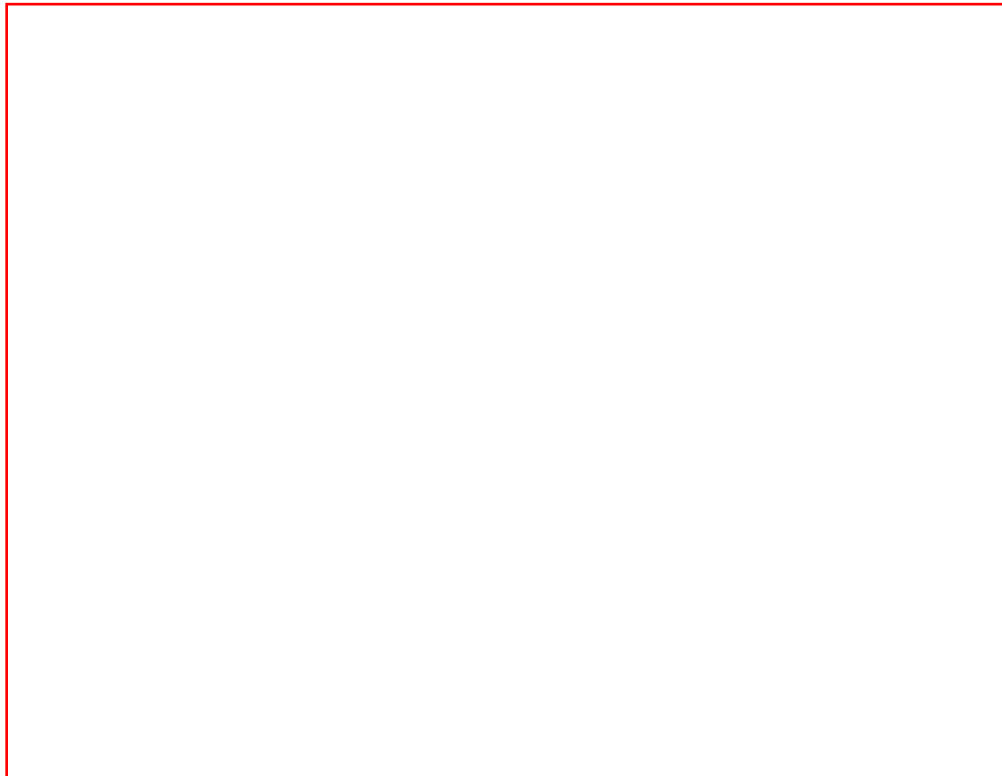
5. Enter the following command to determine if the disk being replaced is mirrored or nonmirrored:

```
/sbin/lvdisplay lv_name
```

where *lv_name* is the path name obtained in Step 4. Repeat for each logical volume.

The display is shown in the following format.

Sample Screen (partial):



The **Mirror** **copies** field shows how many mirrors the disk has (0, 1, or 2).

6. If the disk being replaced is a mirrored LVM disk, remove mirroring for all logical volumes by entering:

```
lvreduce -m 0 lv_path pv_path
```

lv_path is the block device path name of the logical volume and *pv_path* is the pathname of the physical volume (the disk to be replaced). Repeat this command for each logical volume.

7. Remove the disk from its volume group by entering the following command:

```
vgreduce vg_name pv_path
```

where *vg_name* is the path name of the volume group (*/dev/vg00* in the sample **vgdisplay -v** display shown above) and *pv_path* is the path name of the physical volume to be replaced (*/dev/dsk/c0t0d0* in the sample **vgdisplay -v** display shown above).

If the disk being replaced is non-mirrored, move all the data contained on the disk to another disk by entering the following command:

```
/sbin/pvmove source_pv_path
dest_pv_path
```

where the *source_pv_path* argument is the path name of the physical volume to be removed (example: */dev/dsk/c1t0d0*) and the *dest_pv_path* argument is the path name of the destination physical volume (example: */dev/dsk/c0t0d0*).

NOTE: The destination physical volume must be in the same volume group as the source physical volume.

2.7.1.8 Verifying Disk Drive Replacement

After the replacement disk drive is installed, the system automatically tests it and brings it online.

1. Verify that the replacement disk is operational by entering the following command:

```
/sbin/ftsmaint ls hw_path
```

where *hw_path* is the hardware path of the disk drive.

2. Check the **State** and **Status** fields. The **State** field should be listed as **CLAIMED** and the **Status** field should be listed as **Online**.

3. If the disk that was replaced was an online, non-mirrored LVM disk, restore data to the new disk by entering the following command:

```
/sbin/pvmove source_pv_path
dest_pv_path
```

where the *source_pv_path* argument is the path name of the physical volume where the data resides (example: */dev/dsk/c1t0d0*) and the *dest_pv_path* argument is the path name of the new physical volume (example: */dev/dsk/c0t0d0*).

4. If the disk that was replaced was an online, mirrored LVM disk, perform the following steps to ensure that the data on the replacement disk is both synchronized and valid.

- a. Use the **vgcfgrestore** command to restore LVM configuration information to the new disk.

- b. Use the **vgchange -a -y** command to reactivate the volume group to which the disk belongs.
- c. Use the **vgsync** command to manually synchronize all the extents in the volume group.

5. If a failed disk was replaced, restore any volumes that were disabled by the disk drive failure.

For more information on commands pertaining to disk maintenance, refer to the manual *HP-UX Operating System: Fault Tolerant System Administration* (R1004H-04-ST).

2.7.1.9 Preparing to Remove a Tape Drive

Tape drives are not hot pluggable devices. Perform the following steps to suspend operation on the SCSI bus associated with the failed tape drive.

1. Enter the following command to determine the hardware path of the failed tape drive.

```
/sbin/ftsmaint ls
```

2. Determine the hardware path of the tape drive to be removed.

The information in the **State** and **Status** fields of the display will show information on the failed tape drive.

2.7.1.10 Verifying Tape Drive Replacement

1. After the tape drive is configured into the system using the **addhardware** command, verify that the tape drive is configured into the system. To do this, enter the following commands:

```
ioscan -fn -C tape
```

```
ftsmaint ls hw_path
```

where **hw_path** is the hardware path to the tape drive.

2. Confirm that the tape drive is present, **CLAIMED**, and **Online**, and that device special files have been created for it in the **/dev/dsk** and **/dev/rdisk** directories.

There is substantial overlap between the **ftsmaint** and **ioscan** commands, but the **ftsmaint** command does not include the device file names and the **ioscan** command does not include the Status information.

3. Verify that you can read and write to and from the device. One way to do this is through the **tar** command. In the following example, the first **tar** command writes the **/etc/passwd** file to tape using a device special file shown in the **ioscan** output from

step 1. The second **tar** command displays the contents of the tape.

```
tar cvf /dev/rmt/c0t3d0best /etc/passwd
```

```
tar tvf /dev/rmt/c0t3d0best
```

2.7.2 Maintaining Flash Cards

The Continuum 400 Series system contains two flash cards which are located on the PCIB card. The flash cards are 20-MB PCMCIA cards used to perform the primary boot functions. The flash card contains the primary bootloader, a configuration file, and the secondary bootloader. The HP-UX operating system is stored on the root disk and booted from there.

A flash card contains three sections. The first is the label, the second is the primary bootloader, and the third is the LIF.

Label	Primary Bootloader (lynx)	Logical Interchange Format (LIF) - CONF (configuration file) - BOOT (secondary bootloader)
--------------	--------------------------------------	---

The following table describes the LIF files.

File Name	Description
CONF	The bootloader configuration file. This file is equivalent to the /stand/conf file on the root disk.
BOOT	The secondary bootloader image, which is used to boot the kernel.

At system startup, the operating system boots from the flash card and assumes that it contains the correct version of the bootloader configuration file in **CONF**. If there is no **CONF** file, the system cannot boot.

The operating system provides default values for key parameters in the bootloader configuration file. If it is appropriate, permanent changes can be made to the system configuration by editing the **/stand/conf** file on the root disk with a text editor and copying the file to the booting flash card. Whenever you edit the **/stand/conf** file on the root disk you must remove the old copy of the **CONF** file from the flash card (from which you booted) and replace it with the updated version of the **/stand/conf** file before rebooting the system.

You can copy new configuration files and bootloaders to the LIF section using the **flifcp** and **flifrm** commands. The size of the files varies depending on your configuration. You can view the size and order of the files using the **flifls** command.

The LIF section on a flash card has a total space of 81188 blocks of 256K bytes, which is a little less than 20 MB. The following information is provided for each file:

- **filename** - The name of the file.
- **type** - The type of all these files is BIN, or binary.
- **start** - Indicates the block number at which the file starts.

- **size** - The number of blocks used by the file.
- **implement** - Not used and can be ignored.
- **created** - Indicates the date and time the file was written to the flash card.

The flash cards can be read, and written to (as necessary) to update their files. The following utilities are provided to help manage and maintain flash cards:

Utility	Use
flashboot	Copies data from a file on disk to the bootloader area on the flash card. Use this command to copy the bootloader to the flash card. The installation image is stored at /stand/flash/lynx.obj.C
flashcp	Copies data from one flash card to another.
flashdd	Copies data from flash images on disk to a flash card. Use this command to initialize a new flash card with the installation flash card image.
flifcmp	Compare a file on a flash card with a file on the root disk.
flifcp	Copies a file from disk to the flash card or from the flash card to disk.
flifcompact	Eliminates fragmented storage space on the flash card.
flirename	Rename a file on a flash card.
flifrm	Remove a LIF file from a flash card.
flifls	Lists the files stored on a flash card.
showboot	Display the device name of the flash card from which the system was booted.

2.7.2.1 Modifying Configuration Files

HP-UX assumes the flash card the system booted from contains the correct versions of the bootloader

configuration file **CONF**. This file must be kept up-to-date on the flash card. Also, whenever the **/stand/config** file is edited for all changes, it must be copied to the flash card.

When the **addhardware** utility is used to add new hardware to the system, the **/stand/ioconfig** file and flash card are automatically updated so that the configuration will be maintained for all system reboots.

Perform the following steps to replace the **CONF** file on a flash card.

1. Make a copy of the old **CONF** file using the following command:

```
flifcp /dev/rflash/cxa0d0:CONF /tmp/conf.tmp
```

2. Enter the following command to remove the old **CONF** file from the flash card:

```
flifrm /dev/rflash/cxa0d0:CONF
```

where **/dev/rflash/cxa0d0** is the device name of the flash card (**x** is the number of the cardcage where the flash card resides), and **CONF** is the LIF file on the flash card specified by the device name.

3. Enter the following command to copy the new **/stand/conf** to the flash card:

```
flifcp /stand/conf /dev/rflash/cxa0d0:CONF
```

where **/dev/rflash/cxa0d0** is the device name of the flash card (**x** is the number of the cardcage where the flash card resides), and **CONF** is the LIF file on the flash card specified by the device name.

2.7.3 Burning PROM Code

All new or replacement boards come with the latest PROM code already installed. Therefore, it is not necessary to burn the PROM of any new hardware. However, PROM code is occasionally released that must be burned onto existing boards. The following sections describe how to update PROM code.

2.7.3.1 Burning CPU-Memory PROM Code

Use the following procedure to burn new PROM code into CPU-Memory boards.

CAUTION: Do not attempt to update CPU-Memory board PROM code if the system is running with only one CPU-Memory board.

1. Change to the **/etc/stratus/prom_code** directory.

Locate the new PROM code files and determine which file is correct. PROM code file names use the following convention:

```
GNMMScCVV.Vxxx
```

where **GNMM** is the Modelx number, **S** is the submodel compatibility number (**0 - 9**), **cc** is the source code identifier (**fw** is firmware), **VV** is the major revision number (**0 - 99**), **V** is the minor revision number (**0 - 9**), and **xxx** is the file type (**raw** or **bin**). The following is a sample CPU-Memory PROM code file for the online PROM:

```
G8xx0fw38.0.bin
```

2. Choose one of suitcases (0 or 1) and stop its CPU-Memory board from duplexing with its partner by entering the following command:

```
ftsmaint nosync hw_path
```

where *hw_path* is the hardware path of the CPU-Memory board you want to stop duplexing (either 0/0 or 0/1). The partner CPU-Memory board is now handling all system processing.

3. Update the CPU-Memory board PROM by entering the following command:

```
ftsmaint burnprom -f prom_code hw_path
```

where *prom_code* is the full path name of the PROM code file to be downloaded (**/etc/stratus/prom_code/filename**). *hw_path* is the hardware path of the CPU-Memory board specified in Step 2 (either 0/0 or 0/1).

4. Switch processing to the newly updated CPU-Memory board by entering the following command:

```
ftsmaint switch hw_path
```

where *hw_path* is the hardware path of the CPU-memory board specified in Step 2 (either 0/0 or 0/1). This step can take up to five minutes to complete; however, the prompt will return immediately. The **ftsmaint switch** command copies the status of the running CPU-Memory board to the newly updated CPU-Memory board, disables the running board, and then enables the newly updated board.

5. Update the CPU-Memory PROM of the partner CPU-Memory board using the **ftsmaint burnprom** command as described in Step 3.

6. Begin duplexing the boards by entering the following command:

```
ftsmaint sync hw_path
```

where *hw_path* is the hardware path of the CPU-memory board specified in Step 5 (either 0/0 or 0/1). The process is complete when both suitcases show a single green light.

7. Use the **ftsmaint ls** command to check that the boards have been returned to their original status of **Online Duplexed**, and that the **Board Rev** field has the updated with the new revision number.

2.7.3.2 Burning Console Controller PROM Code

The following procedure describes how to burn PROM code into a Console Controller.

1. Change to the **/etc/stratus/prom_code** directory.

Locate the new PROM code files and determine which files are correct. There are three files, one for each PROM on the Console Controller. PROM code file names use the following convention:

MMMMScCVV.Vxxx

where **MMMM** is the Modelx number, **S** is the submodel compatibility number (**0 - 9**), **cc** is the source code identifier (**on** for online, **of** for offline, and **dg** for diagnostic), **VV** is the major revision number (**0 - 99**), **V** is the minor revision number (**0 - 9**), and **xxx** is the file type (**raw** or **bin**). The following are sample Console Controller PROM code files for the online PROM, offline PROM, and diagnostic PROM:

```
E5940on17.0bin
E5940of17.0bin
E5940dg17.0bin
```

2. Enter the following command to determine the location of the standby Console Controller.

```
/sbin/ftsmaint ls
```

The Console Controller Status field will show **Online Standby** for the standby board. The **H/W Path** field shows the hardware path of the Console Controller (either **1/0** or **1/1**).

3. Update the PROM code on the standby Console Controller by entering the following commands:

NOTE: The online PROM must be burned first.

```
/sbin/ftsmaint burnprom -F online -f prom_code  
hw_path  
/sbin/ftsmaint burnprom -F offline -f prom_code  
hw_path  
/sbin/ftsmaint burnprom -F diag-f prom_code hw_path
```

where **prom_code** is the full path name of the PROM code file to be downloaded (**/etc/stratus/prom_code/filename**). **hw_path** is the hardware path of the standby Console Controller (either **1/0** or **1/1**).

NOTE: You must specify the standby Console Controller. An error message will be displayed if you specify the online board.

4. When the prompt returns after burning the last partition, switch the status of the two Console Controllers (the online board becomes the standby board and vice versa) by entering the following command.

```
/sbin/ftsmaint switch hw_path
```

where *hw_path* is the hardware path of the Console Controller specified in Step 3 (either 1/0 or 1/1).

5. Check the status of the newly updated Console Controller using the following command:

```
/sbin/ftsmaint ls hw_path
```

where *hw_path* is the hardware path of the newly updated Console Controller (either 1/0 or 1/1). The Status field should show **Online**.

6. Update the PROM code of the second Console Controller by using the **ftsmaint burnprom** command as described in Step 3.

Once these commands are complete, both Console Controllers will be updated with the same PROM code.

7. Return the Console Controllers to the state in which you found them by switching the online/standby status of the two controllers as described in Step 4.

2.7.3.3 Burning U501 PCI Card PROM Code

Use the following procedure to burn new PROM code into U501 SCSI PCI cards.

1. Check the firmware revision of a U501 card by entering the following command:

```
/sbin/ftsmaint ls hw_path
```

where *hw_path* is the hardware path of the U501 card (U501s have hardware paths 0/2/7/0, 0/2/7/1, 0/2/7/2, 0/3/7/0, 0/3/7/1, and 0/3/7/2).

CAUTION: SCSI adapter cards can have a mix of external devices, or single- or double-initiated buses attached to them. In this procedure, all devices except those connected to the duplexed ports will be disrupted by the PROM update.

2. Notify users of any external devices or single-initiated logical SCSI buses attached to both SCSI adapter cards that service will be disrupted. Disconnect the cables from both ports.

3. Determine which (if any) of the cards you plan to update contain resources (ports) on standby duplexed status by entering the following command:

```
ftsmaint ls hw_path | grep -e Status -e Partner
```

where *hw_path* is the hardware path determined in step 1. For example, to identify the status for the resources at 0/2/7/1, enter the command

```
ftsmaint ls 0/2/7/1 | grep -e Status -e Partner
```

4. Repeat step 3 for each resource in question.

5. Stop the standby resource from duplexing with its partner by entering the following command:

```
ftsmaint nosync hw_path
```

where `hw_path` is the hardware path of the standby resource. For example, to stop 0/3/7/1 from duplexing with 0/2/7/1, you would enter the command **ftsmaint nosync 0/3/7/1**.

Invoking **ftsmaint nosync** on a single resource also stops duplexing and (if necessary) puts on standby status other resources (ports) on that card. Therefore, it is not necessary to repeat this command for the other resources.

CAUTION: The next step stops all communication with devices connected externally to the standby SCSI adapter card.

6. Update the PROM code on the standby card using the hardware address of one of the ports on the card by entering the following:

```
ftsmaint burnprom -f prom_code hw_path
```

where `prom_code` is the path name of the PROM code file, and `hw_path` is the path to the standby card. For example, to update the PROM code in a U501 card in slot 7, card-cage 3, enter the command **ftsmaint burnprom -f u5010fw0st5raw 0/3/7/1**.

7. Restart duplexing between the standby resource and its partner by entering

```
ftsmaint sync hw_path
```

where `hw_path` is the hardware path of the standby resource. For example, to restart duplexing for 0/3/7/1, enter the command **ftsmaint sync 0/3/7/1**.

NOTE: Invoking **ftsmaint sync** on a single resource also restarts (as appropriate) duplexing for other resources (ports) on that card. Therefore, it is not necessary to repeat this command for the other resources.

8. Reverse the standby status of the two cards and stop duplexing by entering the following:.

```
ftsmaint nosync hw_path
```

where `hw_path` is the hardware path of the duplexed port. For example, if 0/2/7/1 is one of the duplexed ports of the active card, enter the command **ftsmaint nosync 0/2/7/1**.

CAUTION: The next step stops all communication with devices connected externally to the standby SCSI adapter card.

9. Update the PROM code on the card that is now standby by entering

```
ftsmaint burnprom -f prom_code hw_path
```

where `prom_code` is the path name of the PROM code file, and `hw_path` is the path to the standby card. For example, to update the PROM code in a U501 card in slot 7, card-cage 2, enter the command **ftsmaint burnprom -f u5010fw0st5raw 0/2/7/1**.

10. When the prompt returns, enter the following command to restart duplexing between the standby resource and its partner (and other resources on that card):

```
ftsmaint sync hw_path
```

where `hw_path` is the hardware path of the standby resource. For example, to restart duplexing for 0/2/7/1, enter the command

```
ftsmaint sync 0/2/7/1
```

11. Check the status of the newly updated card and verify the current (updated) PROM code version by entering the following command for both the resource and its partner:

```
ftsmaint ls hw_path
```

When the status becomes **Online Standby Duplexed**, the card has resumed duplex mode.

3. Fault Isolation

This section contains information used to troubleshoot faults in the system. It contains the following subsections:

- [Component Status LEDs](#)
- [System component LEDs](#)
- [System Log and Status Messages](#)
- [Component Status](#)
- [Fault Codes](#)
- [Troubleshooting Procedures](#)

3.1 Component Status LEDs

3.1.1 General LED information

LEDs can be in a three color arrangement, a two color arrangement or simply a green light. General explanations of these categories follow.

3.1.1.1 Three color LED arrangements

Component status LEDs are either red, green, or yellow. (There is also an amber, system-wide status LED labeled CABINET FAULT at the top of the cabinet in the front and rear.) When grouped in threes, they are arranged as follows: red on top, yellow in the middle, green on the bottom.

They have the following general meanings:*

- A red light indicates that the component is not functioning properly. In most cases, the component is broken and needs to be replaced.
- A yellow light indicates that the component is simplexed--that is, operating without a partner. Do not remove this component. The yellow light is illuminated when the component is in the process of configuring itself with its partner or when its partner has failed. Yellow LEDs can also indicate that a component is performing a self-test.
In most cases, removing a yellow-lit part from the system causes its function to be suspended (except in the PCI card cage on HP-UX systems).
- A green light indicates that the component is operating properly

* The Tray 1 rectifier LED configuration is green/green/red, as explained in section 3.2.1.2.

A given status LED can also flash or remain steadily lit in combination with another status LED to indicate other operating conditions, such as system power-up.

3.1.1.2 Two color LED arrangements

The disk drives and disk power supplies in the disk shelf (PSU0 and PSU1) have only two LEDs, red and green. When a status light is illuminated, it indicates one of the following conditions:

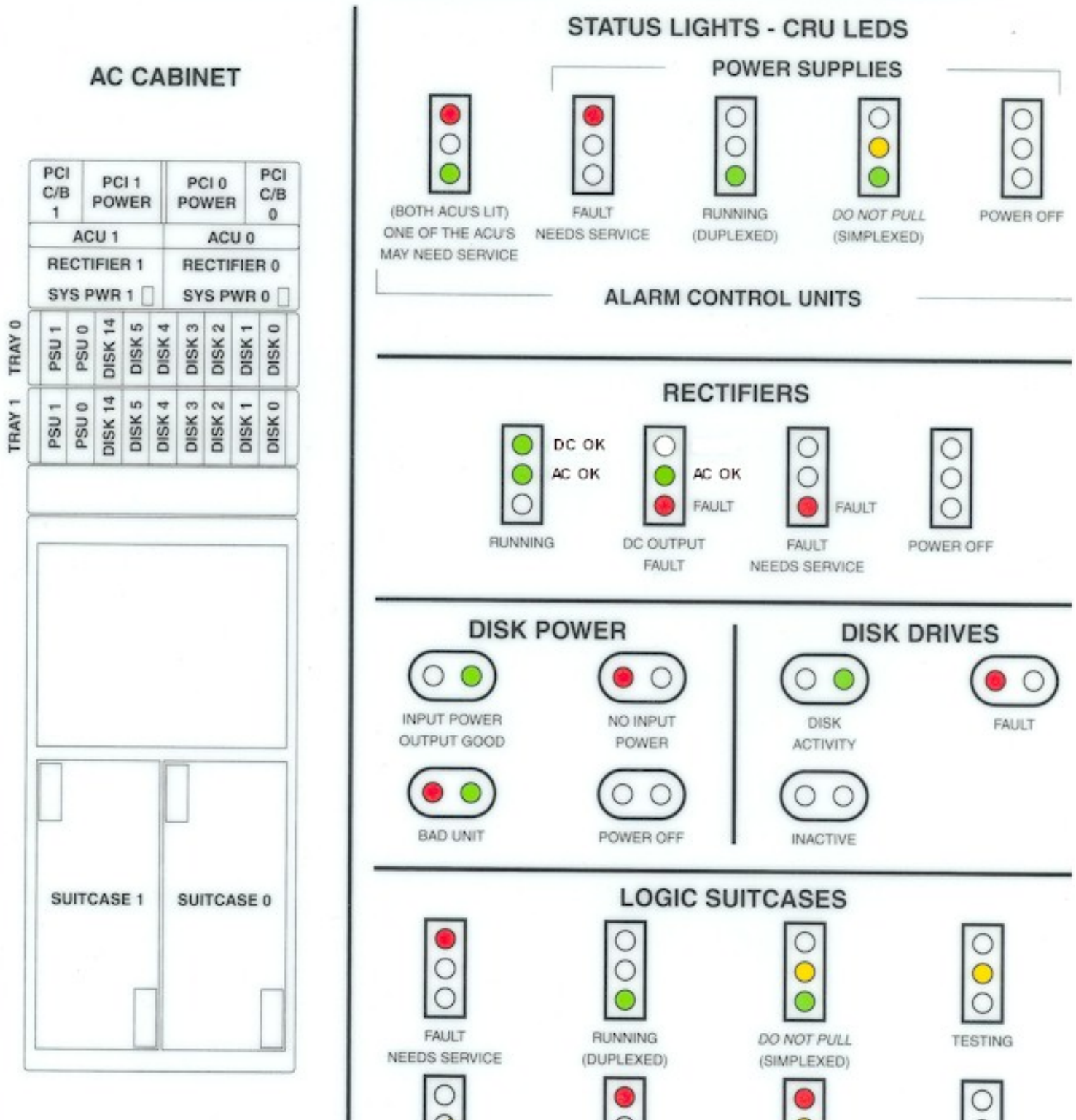
- a red and green light indicates a fault with the disk power supply.
- a red light indicates a fault with the disk drive.
- a green indicates that the system is operating properly.

3.1.1.3 Single LEDs

- If the amber *cabinet fault* LED (at the very top of the cabinet-- front and rear) is illuminated, a CRU within the cabinet has produced an error condition. [Both cabinet fault lights (one front and one rear) are lit when one or more components within the cabinet has failed.]
- If the amber *PCI fault* status LED is lit, there is an error within the PCI card cage. The PCI Fault status LED is located on the front of the cabinet, at the bottom of the disk shelves.
- There are a number of red or green *disk shelf* LEDs in the disk shelf (rear).

3.2. System Component LEDs

The following label, found on the cabinet, shows possible states for component LEDs and describes their meanings.





3.2.1 Power Supply LEDs

3.2.1.1 PCI Power Supply LEDs

LED	State	Meaning
Red	On	The power supply needs service.
Yellow	Off	
Green	Off	
Red	Off	The power supply is simplexed (operating without a partner).
Yellow	On	
Green	On	
Red	Off	The power supply and its partner are running duplexed.
Yellow	Off	
Green	On	
Red	Off	The system is not receiving power.
Yellow	Off	
Green	Off	
Red	On	Both of the ACUs are lit, one of the ACUs may need service.
Yellow	Off	
Green	On	

3.2.1.2 Tray 1 Rectifier Status LEDs

LED	State	Meaning
Green	On	DC output power good.
Green	On	AC input power good.
Red	Off	AC input power good.
Green	Off	
Green	On	
Red	On	DC output power fault.
Green	Off	Unit faulty and needs service.
Green	Off	
Red	On	

Green	Off	Power is off.
Green	Off	
Red	Off	

3.2.1.3 Disk Drive Power Supply Status LEDs

LED	State	Meaning
Red	On	The power supply needs service.
Yellow	Off	
Green	Off	
Red	Off	The power supply is simplexed (operating without a partner).
Yellow	On	
Green	On	
Red	Off	The power supply and its partner are running duplexed.
Yellow	Off	
Green	On	
Red	Off	The system is not receiving power.
Yellow	Off	
Green	Off	
Red	On	Both of the ACUs are lit, one of the ACUs may need service.
Yellow	Off	
Green	On	

3.2.1.4 ACU Status LEDs

Color	State	Meaning
Red	On	One of the ACUs may need service. Both ACUs display this combination at the same time to indicate that the status comparison has failed.
Yellow	Off	
Green	On	
Red	On	The ACU needs service.
Yellow	Off	
Green	Off	
Red	Off	The ACU is simplexed, operating without a partner.
Yellow	On	
Green	On	

Red	Off	The ACU and its partner are running duplexed.
Yellow	Off	
Green	On	
Red	Off	The system is not receiving power.
Yellow	Off	
Green	Off	

3.2.2 Disk Drives

3.2.2.1 Disk Drive Status LED

Color	State	Meaning
Red	Off	Disk is active.
Green	On	
Red	On	This is a faulty disk drive.
Green	Off	
Red	On	The disk drive is simplexed.
Green	On	
Red	Off	The disk drive is inactive.
Green	Off	

3.2.2.2 Terminator Module

This unit should be located above the three fan modules on the right of each of the two disk shelf backplanes. Since the terminator should always be in S/E mode:

- The green LED over "S/E" on the right should be on
- The green LED over "LVD" (Low Voltage Differential) should not be on.

3.2.2.3 SES Unit Module

This unit is located above the three fan modules at the top middle of each of the two disk shelf backplanes. There is a LED above the word "Temp", this LED is not used and should not be on. Next to "Temp" there is a "Mute" knob, this also is not used and shouldn't be touched.

3.2.2.4 SE-SE I/O Repeater Module

This unit should be located above the three fan modules at the top left of each of the two disk shelf backplanes. The SE-SE input unit insures that the terminator will be in SE mode. There are no LEDs to be concerned with in the SE-SE I/O Repeater Module.

3.2.2.5 Fan Units (3)

Three fan units are located on the bottom part of each of the disk shelf backplanes.

The red LEDs in the Fan units should not be illuminated. If a red LED is on in one of the fan units, that unit should be replaced fairly soon (the system is capable of running with only two fans but it is recommended that all three fans be operational at all times).

3.2.3 Suitcase LEDs

3.2.3.1 Suitcase Power-On LED Sequence

Power-Up Stage	Color	State	Meaning
1	Red	Off	The suitcase is performing its self-test.
	Yellow	On	
	Green	Off	
2	Red	Off	The suitcase has passed its self-test and is being configured by the system.
	Yellow	Flashing	
	Green	Off	
3	Red	Off	The suitcase and its partner are online.
	Yellow	Off	
	Green	On	
4	Red	Off	The suitcase is online, but operating simplexed.
	Yellow	On	
	Green	On	

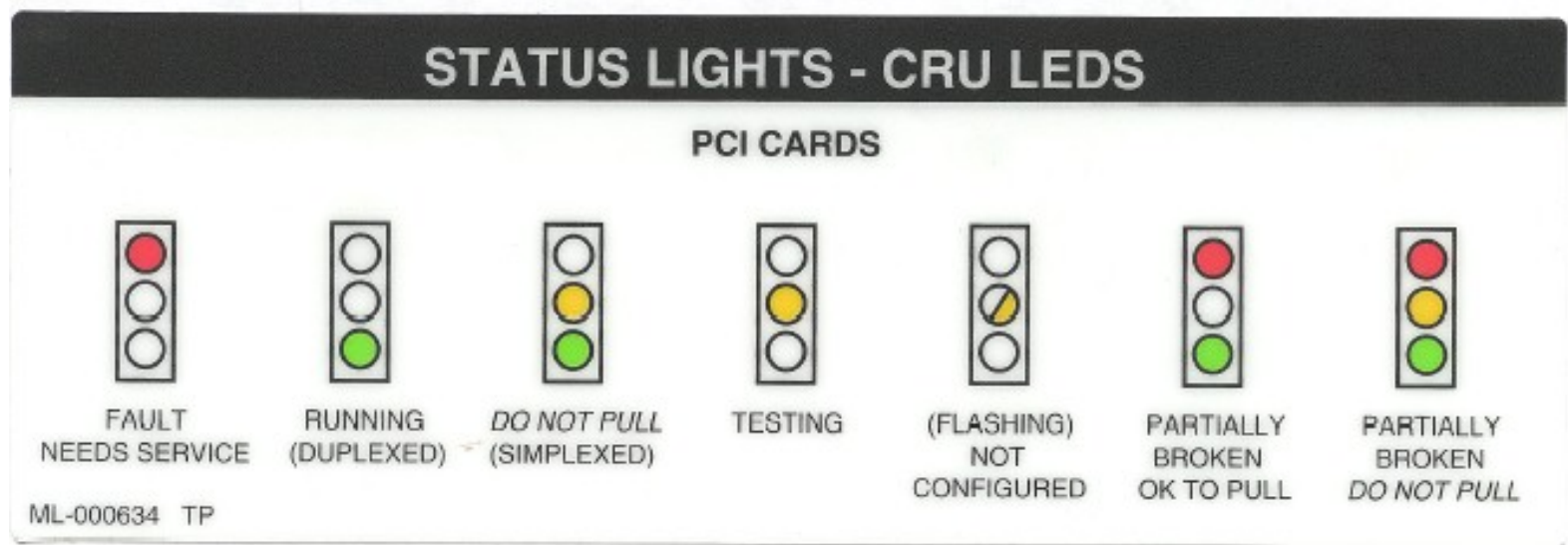
3.2.3.2 Suitcase Status LEDs

Color	Suitcase 1	Suitcase 0	Meaning
Red	On	Off	Suitcase 1 is broken, and suitcase 0 is simplexed (operating without its partner).
Yellow	Off	On	
Green	Off	On	
Red	Flashing	Off	Suitcase 1 is partially broken; a component within the suitcase has failed.
Yellow	Off	On	
Green	On	On	
Red	Flashing	Flashing	A component within suitcase 1 has failed, and a different component within suitcase 0 has failed. Both suitcases have simplexed components.
Yellow	On	On	
Green	On	On	

Red	Off	Off	Suitcase 1 is not receiving power.
Yellow	Off	On	
Green	Off	On	
Red	Off	Off	Both suitcases or the system is not receiving power.
Yellow	Off	Off	
Green	Off	Off	

3.2.4 PCI Cards

The PCI card cage label, shown below, is found on the PCI card cage (cabinet front). It shows possible states for PCI LEDs and describes their meanings.



3.2.4.1 PCI Bridge Card Status LEDs

Color	State	Meaning
Red	On	The PCI bridge card or flash card needs service.
Yellow	Off	
Green	Off	
Red	Off	PCI bridge card and its card cage are fully operational. If both card cages show this state, the PCI bridge cards are duplexed. NOTE: For HP-UX, the fully operational state is green and yellow LEDs are on.
Yellow	Off	
Green	On	
Red	Off	The PCI bridge card is simplexed, operating without a partner.
Yellow	On	
Green	On	

Red	Off	The PCI bridge card is performing a self-test.
Yellow	On	
Green	Off	
Red	Off	The PCI bridge card is not configured.
Yellow	Flashing	
Green	Off	
Red	On	The PCI bridge card is partially broken, it is OK to pull this card.
Yellow	Off	
Green	On	
Red	On	The PCI bridge card is partially broken, do not pull this card.
Yellow	On	
Green	On	

3.3 System Log and Status Messages

System logs contain information concerning major system events and the time they occurred which can help detect and evaluate system problems. Each time a significant event occurs, the syslog message logging facility enters an error message into the systemlog at **/var/adm/syslog/syslog.log**.. Depending upon the severity of the error and the phase of system operation, the same message might also be displayed on the console.

Several HP-UX commands provide status information about components or services. These commands are listed in the following table.

Command	Type of Information
ftsmaint and ioscan	Hardware information
sar	System performance information
sysdef	Kernel parameter information
lp and lpstat	Print services information
ps	Process information
pwck and grpck	Password inconsistencies information
who and whodo	Current user information
ifconfig , netstat , ping , uustat , and lanscan	Network services information
ypcat , ypmatch , yppoll , and ypwhich	Network Information Service (NIS) information

df and du	Disk and volume information
-------------------------	-----------------------------

3.4 Component Status

The **ftsmaint ls** command lists the components in the system and identifies any components that have been removed from service. The list serves as a simple troubleshooting tool to verify that all the components are present and shows their status (in/out of service). Refer to [Section 2.6.3](#) to view a sample **ftsmaint ls** output screen.

3.4.1 Software State Information

The system creates a node for each hardware device that is either installed or listed in the **/stand/ioconfig** file.

The **State** field in the **ftsmaint ls** display can show a hardware component to be in any one of the software states shown in the following table.

State	Meaning
UNCLAIMED	Initialization state, or hardware exists, and no software is associated with the node.
CLAIMED	The driver recognizes the device.
ERROR	The device is recognized, but it is in an error state.
NO_HW	The device at this hardware path is no longer responding.
SCAN	Transitional state that indicates the device is locked. A device is temporarily put in the SCAN state when it is being scanned by the ioscan or ftsmaint utilities.

The software state of a hardware component can change. For example, a component is initially created in the **UNCLAIMED** state when it is detected at boot time. The component moves to the **CLAIMED** state when it is recognized and claimed by the appropriate driver. The transitions between the various software states are controlled by the **ioscan** and **ftsmaint** utilities.

3.4.2 Hardware Status Information

In addition to a software state, each hardware component has a particular hardware status. The **Status** field in the **ftsmaint ls** display can have any of the values shown in the following table.

Status	Meaning
Online	The device is actively working.
Online Standby	The device is not logically active, but it is operational. Using the ftsmaint switch or ftsmaint sync command can be used to change the device status to Online .
Duplexed	The status is appended to the Online status to indicate that the device is fully duplexed.

Duplexing	The status is appended to the Online or Online Standby status to indicate that the device is in the process of duplexing. This transient status is displayed after the ftsmaint sync or ftsmaint enable command has been used on the CPU-Memory board.
Offline	The device is not functional or not being used.
Burning PROM	The ftsmaint burnprom command is in progress on the device.

The status of a hardware component can change. For example, a component could go from **Online** to **Offline** because of a hardware or software error.

3.5 Fault Codes

The fault tolerant services return fault codes when certain events occur. Fault codes are displayed by the **ftsmaint ls** command in the FCode field and by the **ftsmaint ls -l** command in the Fault Code field. The following table lists and describes the fault codes.

Short Format ls Format	Long Format ls -l Format	Explanation
2FLT	Both ACUs Faulted	Both ACUs are faulted.
ADROK	Cabinet Address Frozen	The cabinet address is frozen.
BLINK	Cabinet Fault Light Blinking	The cabinet fault light is blinking.
BPPS	BP Power Supply Faulted/Missing	The BP power supply is either faulted or missing.
BRKOK	Cabinet Circuit Breaker(s) OK	The cabinet circuit breaker(s) are OK.
CABACU	ACU Card Faulted	The ACU card is faulted.
CABADR	Cabinet Address Not Frozen	The cabinet addresses are not frozen.
CABBFU	Cabinet Battery Fuse Unit Fault	The cabinet battery fuse unit fault occurred.
CABBRK	Cabinet Circuit Breaker Tripped	A circuit breaker in the cabinet was tripped.
CABCDC	Cabinet Data Collector Fault	The cabinet data collector faulted.
CABCEC	Central Equipment Cabinet Fault	A fault was recorded on the main cabinet bus.
CABCFG	Cabinet Configuration Incorrect	The cabinet contains an illegal configuration.
CABDCD	Cabinet DC Distribution Unit Fault	A DC distribution unit faulted.
CABFAN	Broken Cabinet Fan	A cabinet fan failed.
CABFLT	Cabinet Fault Detected	A component in the cabinet faulted.
CABFLT	Cabinet Fault Light On	The cabinet fault light is on.
CABLE	PCI Power Cable Missing	This PCI backpanel cable is not attached.
CABPCU	Cabinet Power Control Unit Fault	A power control unit faulted.
CABPSU	Cabinet Power Supply Unit Fault	A power supply unit faulted.
CABPWR	Broken Cabinet Power Controller	A cabinet power controller failed.
CABTMP	Cabinet Battery Temperature Fault	A cabinet battery temperature above the safety threshold was detected.

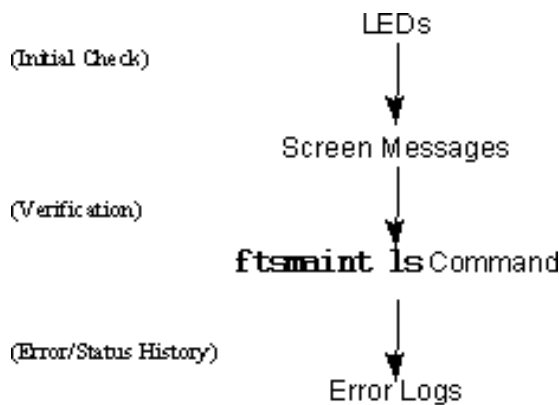
CABTMP	Cabinet Temperature Fault	A cabinet temperature above the safety threshold was detected.
CDCREG	Cabinet Data Registers Invalid	The cabinet data collector is returning incorrect register information. Upgrade the unit.
CHARGE	Charging Battery	A battery CRU/FRU is charging. To leave this state, the battery needs to be permanently bad or fully charged.
DSKFAN	Disk Fan Faulted/Missing	The disk fan either faulted or is missing.
ENC OK	SCSI Peripheral Enclosure OK	The SCSI peripheral enclosure is OK.
ENCFLT	SCSI Peripheral Enclosure Fault	A device in the tape/disk enclosure faulted.
FIBER	Cabinet Fiber-Optic Bus Fault	The cabinet fiber-optic bus faulted.
FIBER	Cabinet Fiber-Optic Bus OK	The cabinet fiber-optic bus is OK.
HARD	Hard Error	The driver reported a hard error. A hard error occurs when a hardware fault occurs that the system is unable to correct. Look at the sys log for related error messages.
HWFLT	Hardware Fault	The hardware device reported a fault. Look at the sys log for related error messages.
ILLBRK	Cabinet Illegal Breaker Status	The cabinet data collector reported an invalid breaker status.
INVREG	Invalid ACU Register Information	A read of the ACU registers resulted in invalid data.
IPS OK	IOA Chassis Power Supply OK	The IOA chassis power supply is OK.
IPSFlt	IOA Chassis Power Supply Fault	An I/O Adapter power supply fault was detected.
IS	In Service	The CRU/FRU is in service.
LITEOK	Cabinet Fault Light OK	The cabinet fault light is OK.
MISSNG	Missing replaceable unit	The ACU on the DNCP Series 400-CO (PA-8500) is missing, electrically undetectable, removed, or deleted.
MTBF	Below MTBF Threshold	The CRU/FRU's rate of transient and hard failures became too great.
NOPWR	No Power	The CRU/FRU lost power.
OVERRD	Cabinet Fan Speed Override Active	The fan override (setting fans to full power from the normal 70%) was activated.
PC Hi	Power Controller Over Voltage	An over-voltage condition was detected by the power controller.
PCIOPN	PCI Card Bay Door Open	The PCI card-bay door is open.
PCLOW	Power Controller Under Voltage	An under-voltage condition was detected by the power controller.
PCVOTE	Power Controller Voter Fault	A voter fault was detected by the power controller.
PSBAD	Invalid Power Supply Type	The power supply ID bits do not match that of any supported unit.
PSU OK	Cabinet Power Supply Unit(s) OK	The cabinet power supply unit(s) are OK.
PSUs	Multiple Power Supply Unit Faults	Multiple power supply units faulted in a cabinet.
PWR	Breaker Tripped	The circuit breaker for the PCIB power supply tripped.
REGDIF	ACU Registers Differ	A comparison of the registers on both ACUs showed a difference.

SOFT	Soft Error	The driver reported a transient error. A transient error occurs when a hardware fault is detected, but the problem is corrected by the system. Look at the syslog for related error messages.
SPD OK	Cabinet Fan Speed Override Completed	The cabinet-fan speed override completed.
SPR OK	Cabinet Spare (PCU) OK	The cabinet spare (PCU) is OK.
SPRPCU	Cabinet Spare (PCU) Fault	The power control unit spare line faulted.
TEMPOK	Cabinet Temperature OK	The cabinet temperature is OK.
USER	User Reported Error	A user issued ftsmaint disable to disable the hardware device.

3.6 Troubleshooting Procedures

When a fault occurs, several things can happen. If it is a non-critical fault, the system will continue to process data. If it is a critical fault, the system (or a subsystem) may be inoperative. When troubleshooting the system, determine the fault first by using the LEDs and screen messages. Then, verify that the component(s) is out of service using the **ftsmaint ls** command ([Section 2.6.3](#)), error logs, and diagnostic tests. This flow is shown in the Troubleshooting Flow below.

Troubleshooting Flow



When troubleshooting system faults, use the following process:

- Check the console terminal for fault information.
- Locate the failed component(s) using the LEDs.
- Verify the component is bad by using software commands/error logs.
- Remove and replace the failed component.
- Check to make sure the problem is resolved.

4a. Hardware Removal and Replacement Procedures

This section lists the Field Replaceable Units (FRUs) and Distributor Replaceable Units (DRUs) in the PA-8500 Continuum Series 400 system and describes the removal and replacement procedures for each one. In some instances, FRUs/DRUs are duplexed and may be removed and replaced without total removal of power, and thus, without loss of continuous processing. However, in most instances, the system must be shut down and both main power switches turned off prior to removal and replacement of the FRU/DRU. The list of FRUs/DRUs in the following table notes which FRUs/DRUs require which degree of power removal before removal and replacement procedures can be performed.

4.1 List of FRUs/DRUs

The following table lists the FRUs/DRUs in the PA-8500 Continuum Series 400 system and shows the location of each FRU/DRU. It also indicates whether or not the FRU/DRU requires any degree of power removal.

FRU/DRU	Location	Power Removal Required
AC Power Chassis/Suitcase Cable Assembly (AW-001038)	Mounted on Tray 1 rear and connects suitcase power supply to AC power chassis.	System must be shutdown and both main power switches turned off.
Tray 1 (Power Front End Tray) (AA-P28200)	Above the disk shelves and below Tray 2.	System must be shutdown and both main power switches turned off.
Tray 2 (PCI/ACU Power Tray) (AA-P28300)	Above the disk shelves and Tray 1.	System must be shutdown and both main power switches turned off.
CPU Backplane (AA-E25800)	Below PCI card cages.	System must be shutdown and both main power switches turned off.
PCI Backplane (AA-E26100)	Below disk shelves.	System must be shutdown and both main power switches turned off.
Backplane Interconnect PCB (AA-E26200)	Connects PCI backplane to CPU backplane.	System must be shutdown and both main power switches turned off.
PCI Fault Display PCB (AA-E26600)	On top of PCI card cage.	PCI power supply on the affected side of cabinet must be turned off.
Cabinet Fault Display PCB (AA-E26500)	On top of cabinet.	System must be shutdown and both main power switches turned off.
Disk Shelf (AA-D84000, AA-D84001) (84000 is the disk shelf with fans, SES and 48v DC Power Supplies; AA-D84001 is the empty disk shelf-used for replacements)	Below power chassis.	Cabinet must be shutdown and both main power switches turned off.

<u>Disk Shelf Power Cable</u> (AW-001036)	Connects disk shelf to power chassis.	Cabinet must be shutdown and both main power switches turned off. For the hot pluggable procedure (also listed) system shutdown is not necessary.
<u>Disk Shelf SCSI Data Cable</u> (AW-001034)	Connects lower/upper disk shelf (via SCSI signal repeater) to PCI backplane.	Cabinet must be shutdown and both main power switches turned off.
<u>CPU Backplane Power Cable</u> (AW-001048)	Connects CPU backplane to DC power chassis.	Cabinet must be shutdown and both main power switches turned off.
<u>PCI Backplane Power Cable</u> (AW-001047)	Connects PCI backplane to DC power chassis.	Cabinet must be shutdown and both main power switches turned off.
<u>SCSI Data Cable - PCI Bridge Card/PCI Backplane</u> (AW-000954)	Connects PCI bridge card to PCI backplane.	Both PCI power supplies must be turned off.
<u>Cable - PCI Backplane/PCI Fault Display PCB</u> (AW-001113)	Connects PCI backplane to PCI fault display PCB.	PCI power supply on the affected side of cabinet must be turned off.
<u>U450 16-port Support Bracket</u> (AK-000331)	Mounted on rear cabinet PCI card cage.	No power removal necessary.
<u>PCI Fault Display Cable</u> (AW-000982)	Connects cabinet fault display PCB to PCI fault LED.	No power removal necessary.
<u>Cabinet Fault Display PCB Cable</u> (AW-000959)	Connects PCI backplane to cabinet fault display PCB.	No power removal necessary.
<u>Cable - Cabinet Fault Display PCB/Cabinet Fault LEDs</u> (AW-000985)	Connects cabinet fault display PCB to cabinet fault LEDs.	No power removal necessary.

The following are optional FRUs whose installation is documented in the *PA-8500 Continuum Series 400 Unpacking Instructions*:

- Seismic 4 mounting kit (AX-000063)
- Seismic 1 mounting kit (AX-000064)

4.2 System Shutdown/Startup

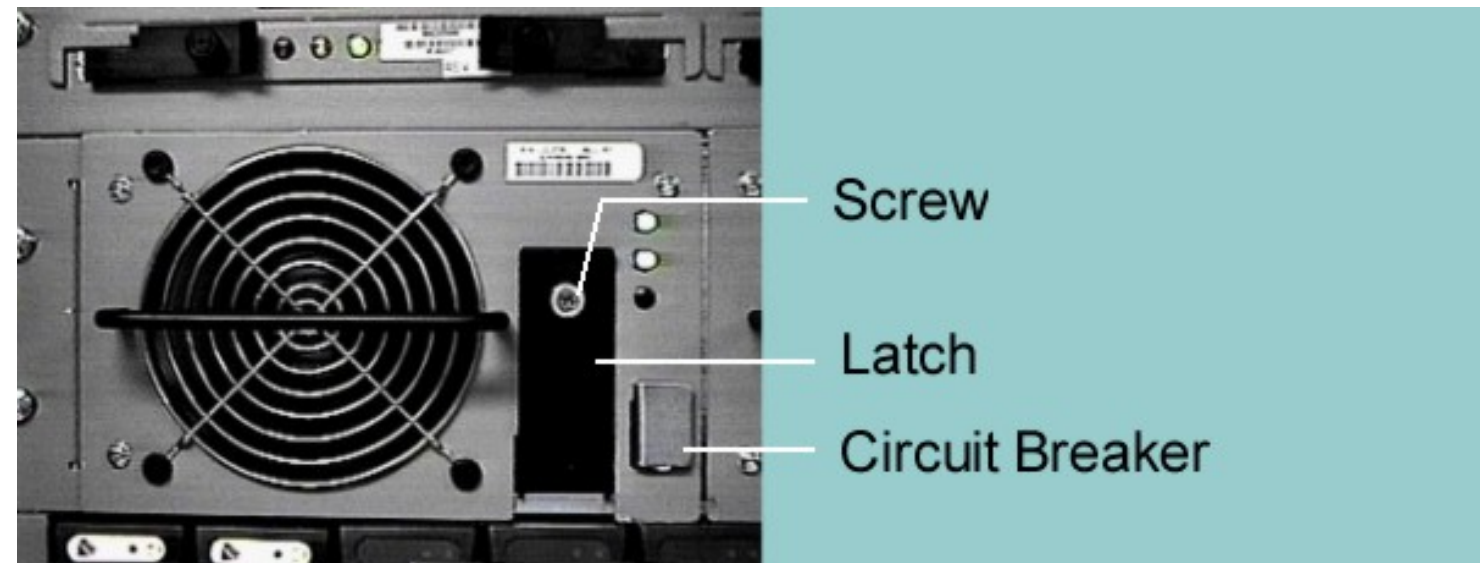
If total power removal is required, the system must be shut down prior to removing power and rebooted after the replacement unit is installed. Refer to Section 2 for the system shutdown procedure.

4.3 Power Removal

Power is removed from one side of the system by lifting the appropriate AC circuit breaker, then unscrewing the thumbscrew and pulling out the latch, which turns off the power to that side. This will simplex the system. If the system must be powered down completely, do the above procedure on both sides.
(See Figure 4-1)

CAUTION: If the system needs to be simplex (power removed from one side of the cabinet), verify that there are no red LEDs or system console messages indicating a failed duplexed component on the side of the system that will remain powered on. If both components in a duplexed pair are removed, a system crash will occur.

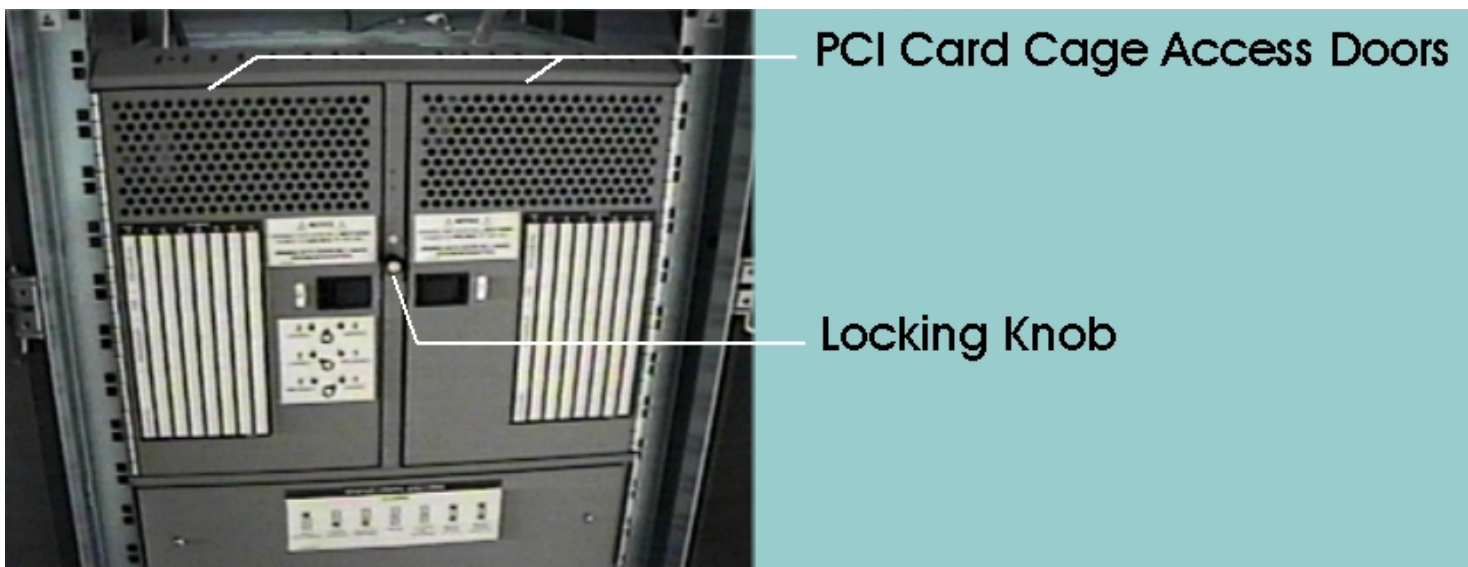
Figure 4-1. Main Power Switch/AC Input Breaker



4.4 Access Doors

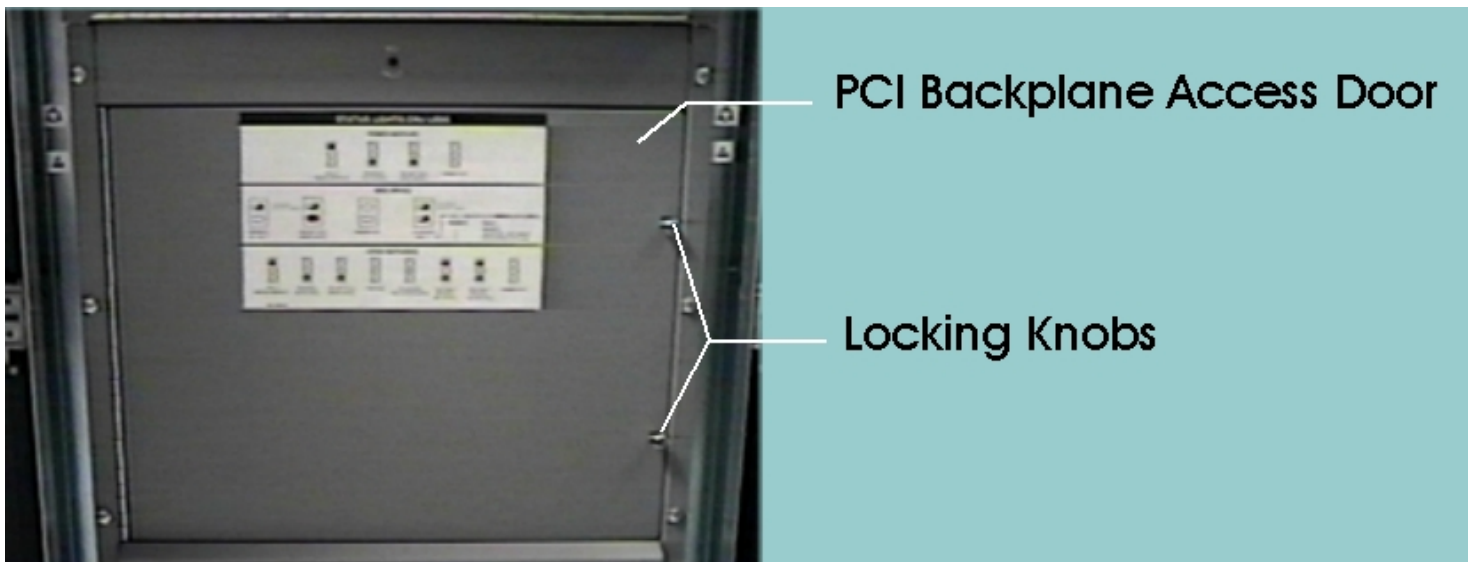
The access doors that often need to be opened in order to access FRUs are the PCI card cage access doors and the access door behind the PCI backplane. These are shown in Figure 4-2 and Figure 4-3. Refer to them as necessary during the FRU removal procedures.

Figure 4-2. PCI card Cage Access Doors (Rear of system)



NOTE: Open one PCI card cage door at a time

Figure 4-3. PCI Backplane Access Door (Front of system)



NOTE: To open the locking knobs on the PCI backplane access door, you may need a torx head wrench tool.

4.5 Hardware Removal Procedures

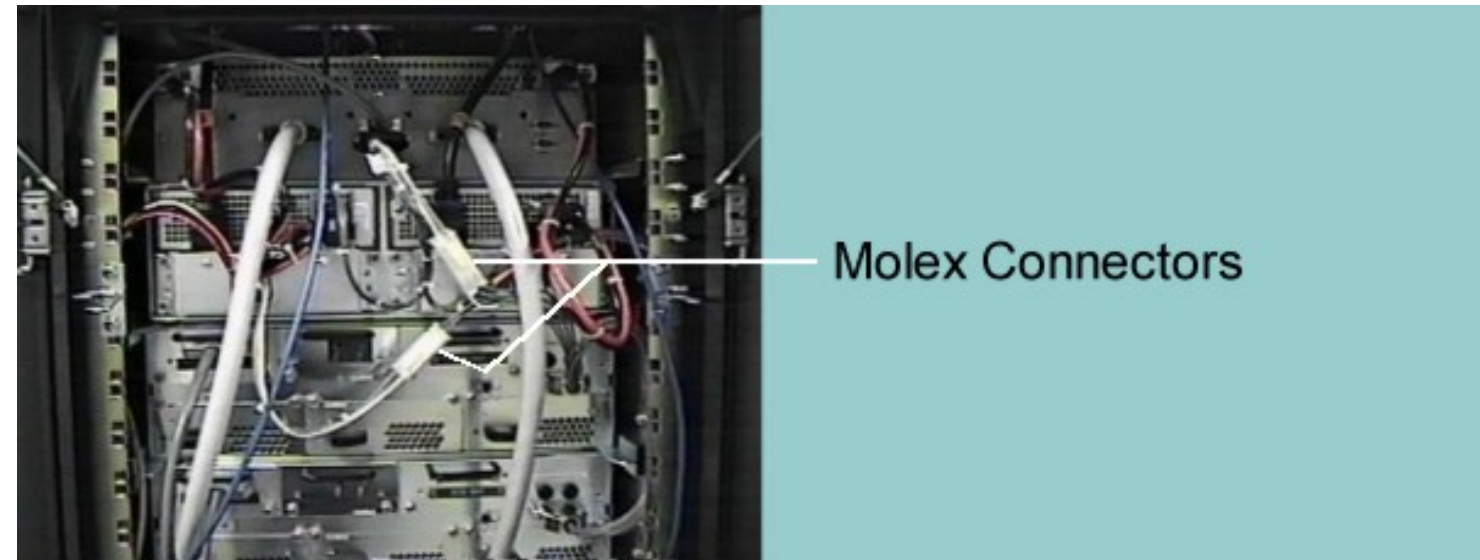
This section contains the removal procedures for the FRUs listed in the preceding table. Each of these procedures indicates any power removal requirements for the FRU. If a customer replaceable unit (CRU) needs to be removed during the procedure, it is designated as a CRU. If necessary, refer to *Chapter 3* in the *HP-UX Operating System: Continuum Series 400 Operation and Maintenance Guide Release 1.0 (R025H-01-ST)* for its removable procedure.

To perform the replacement procedure for each FRU, reverse the removable procedure. If any special replacement considerations are necessary, a replacement note is included.

4.5.1 AC Power Chassis/Suitcase Cable Assembly (AW-001038)

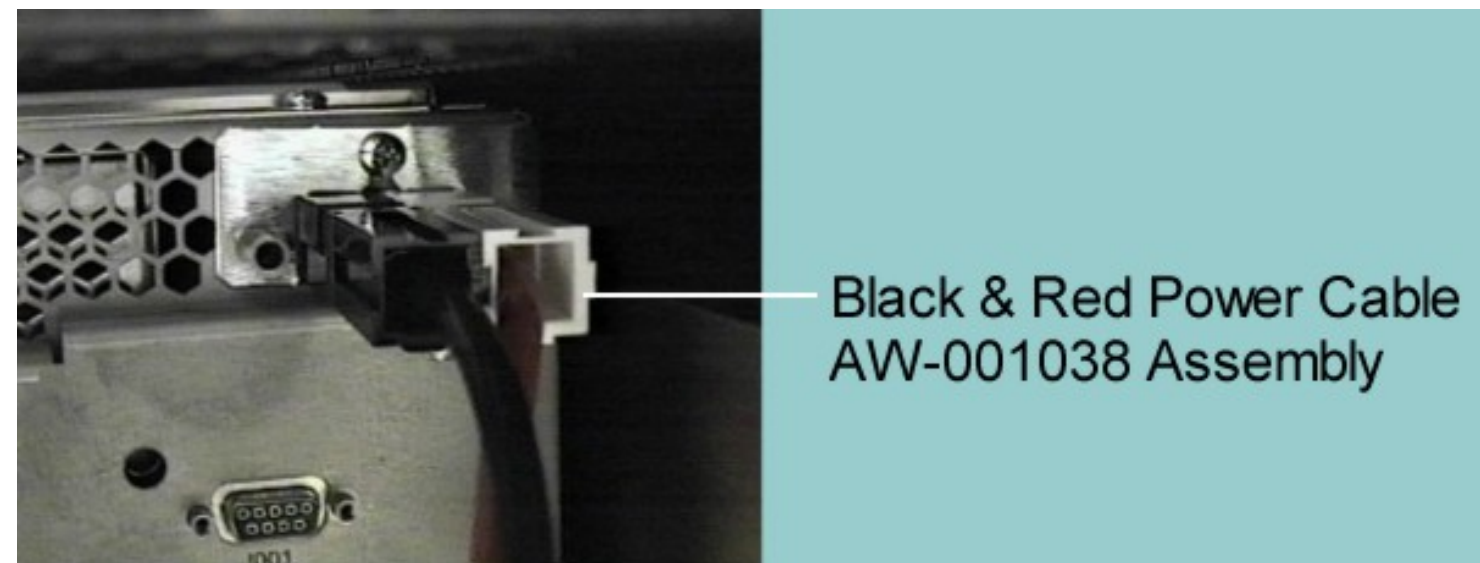
1. Shut down the system from the system console.
2. Open the cabinet front door and turn off the main power switch/AC circuit breaker (located in Tray 1) that provides power to the side of the cabinet containing the failed suitcase power cable.
(See Figure 4-1.)
3. Open the cabinet rear door and disconnect the Molex connector (P3 or P4) of the AW-001036 cable on the faulty side (See Figure 4-4)

Figure 4-4. Disconnecting the Molex Connector on the AW-001036 Cable



4. Disconnect the red and black power cable from the very top left or right of Tray 2 (depending on which side is faulty). The other end of this is permanently attached to the AW-001038 assembly. (See Figure 4-5)

Figure 4-5. Disconnecting the Red and Black Cables from the AC Power Chassis

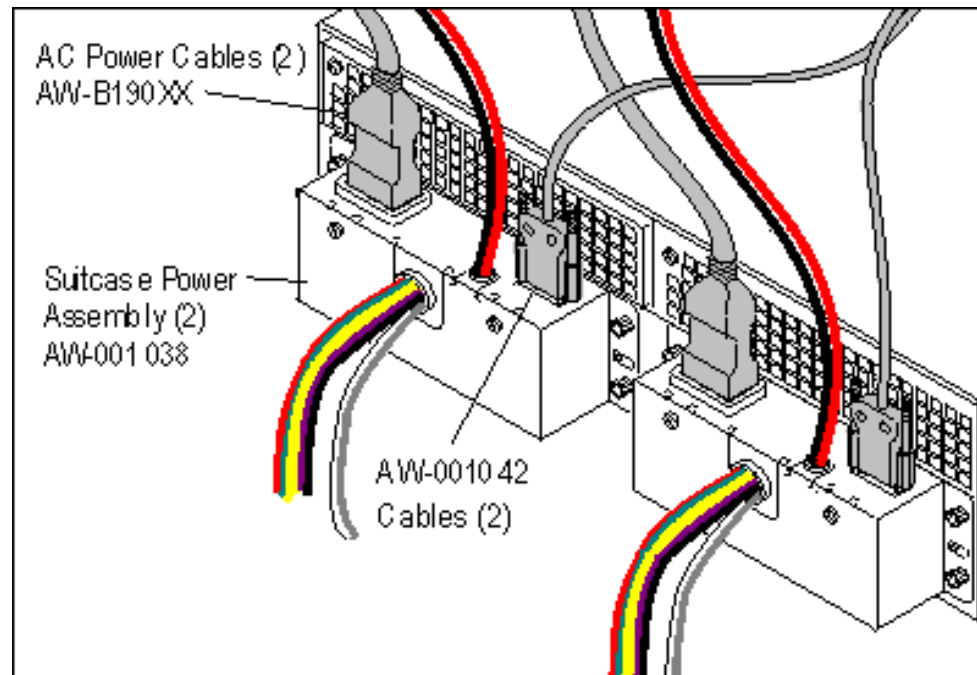


Refer to Figure 4-6 when performing the following step.

5. Disconnect the cables connected to the faulty AW-001038 assembly at the AC power tray 1 (rear). Some of the cables do not detach from the AW-001038 assembly and therefore do not have separate part numbers.

- One AW-001042 cable from AW-001038 assembly (P2 or P3)
- One AW-B1901X AC power cord from the top left of the left or right AW-001038 assembly (depending on which side is faulty).

Figure 4-6. Disconnecting the Cables from the AC Power Chassis



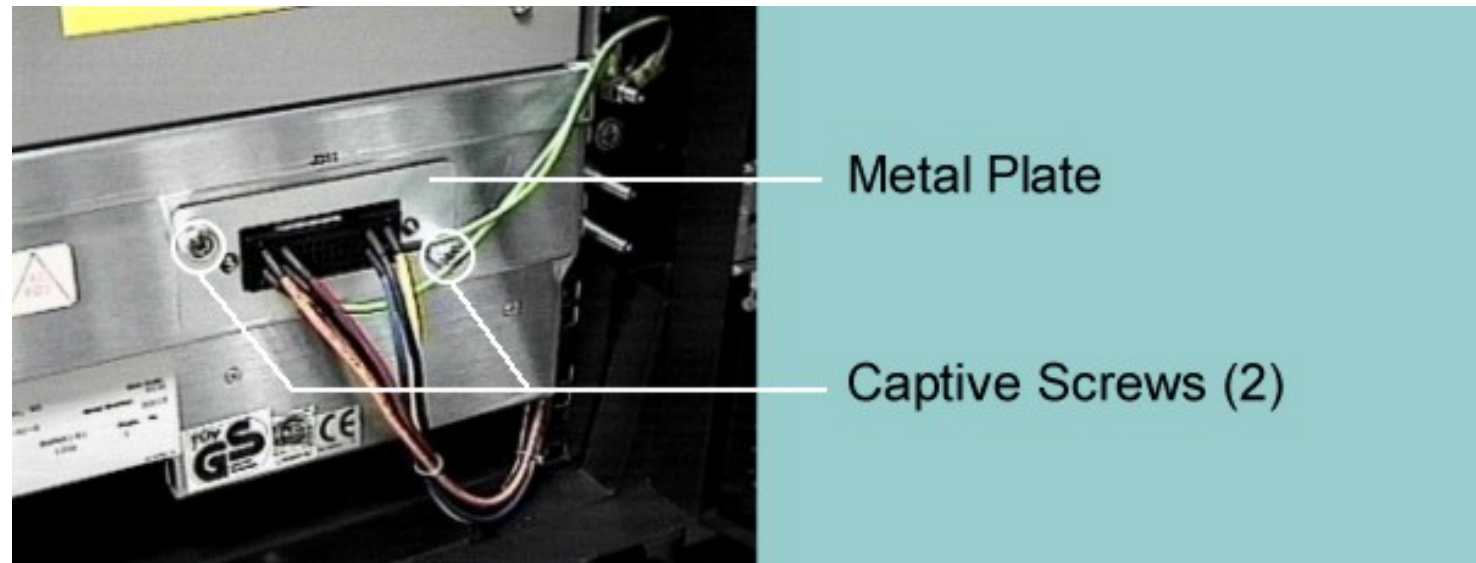
6. At the bottom rear of the cabinet, remove the nut securing the two ground wires to the cabinet frame. (See Figure 4-7.)

Figure 4-7. Removing the Ground Wires from the Cabinet Frame



7. Loosen the two captive screws and remove the metal plate of the AW-001038 cable assembly, at J310 or J311 (depending on which side is faulty). This is located below the suitcase chassis in the cabinet rear . (See Figure 4-8.)

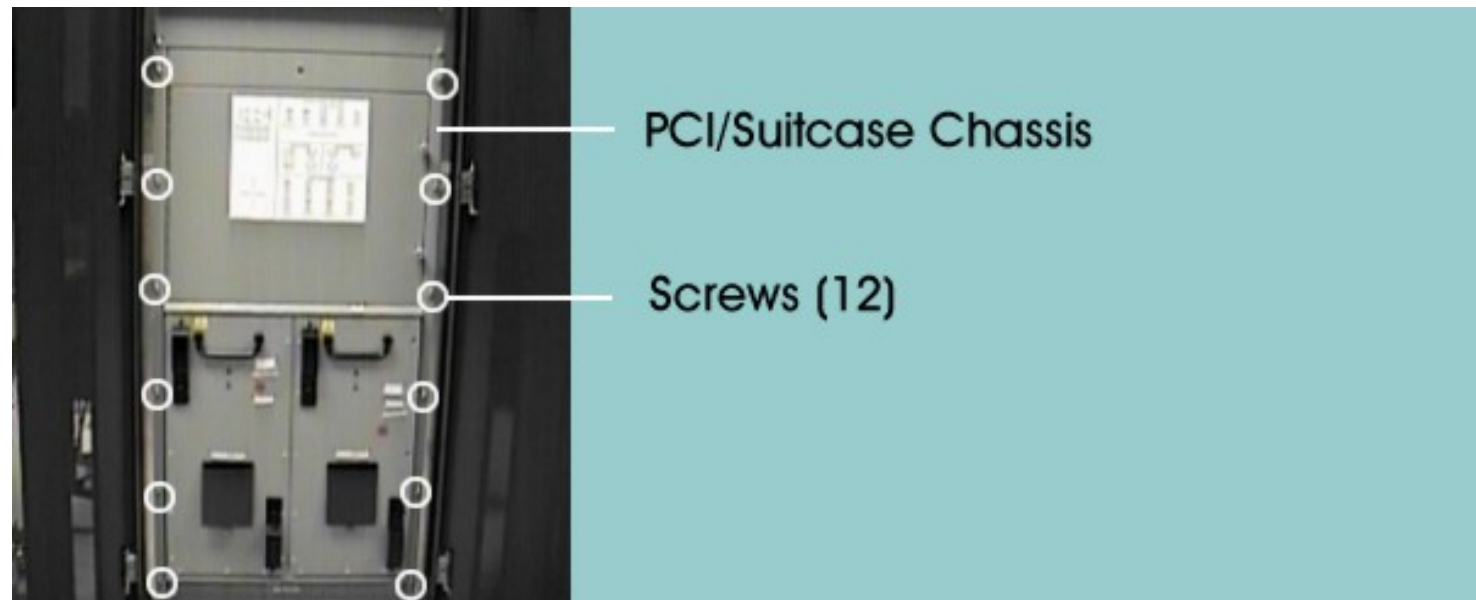
Figure 4-8. Removing the Metal Plate from the Suitcase Power Cable



To disengage the (six-wire) multicolored cable (of the AW-001038 assembly) complete the following steps:

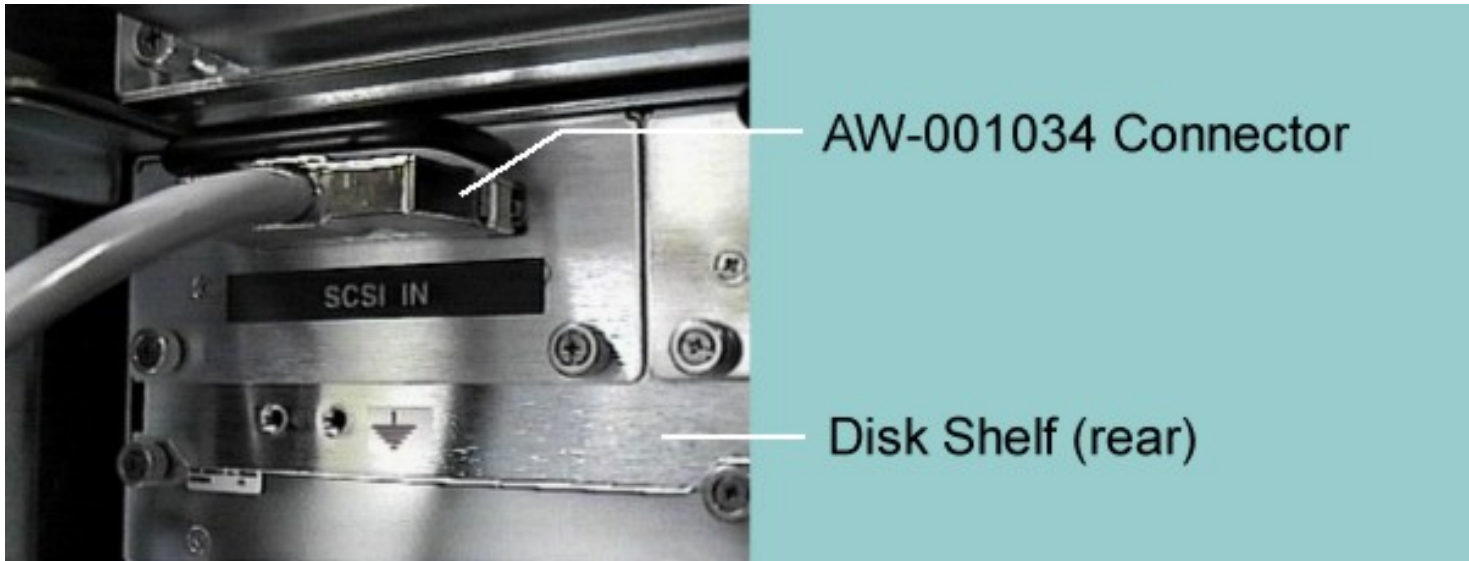
8. Remove the 12 screws securing the PCI/suitcase chassis. (See Figure 4-9.)

Figure 4-9. Removing the Screws from PCI/Suitcase Chassis



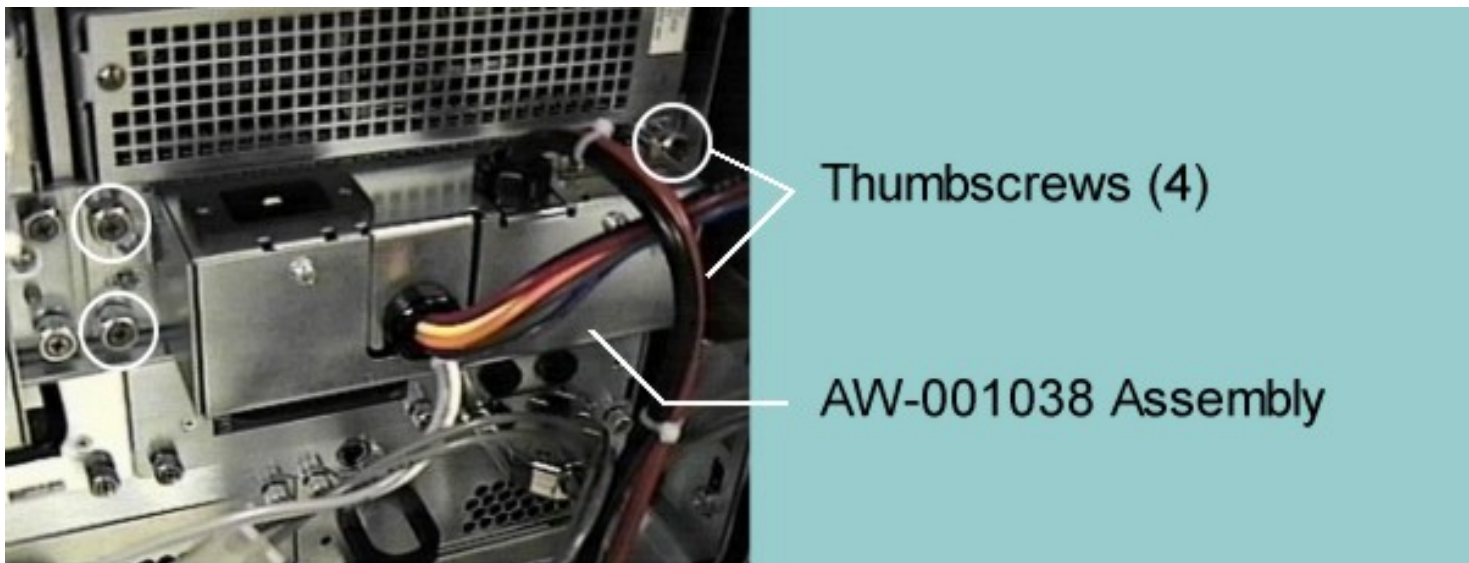
9. Disconnect the two AW-001034 cables from the rear of the disk shelf. This step is necessary so that the AW-001034 cables are not strained while moving the PCI/suitcase chassis. (See Figure 4-10.)

Figure 4-10. Disconnecting the AW-001034 Cables from the Disk Shelf

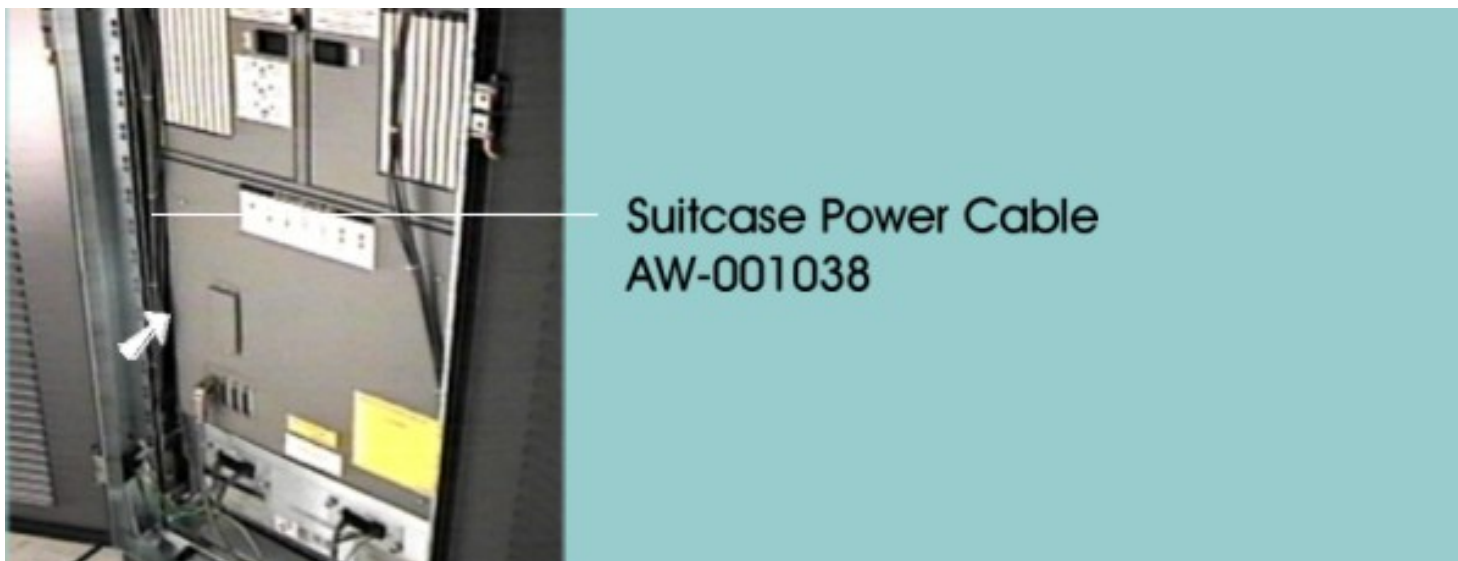


10. Remove the major four thumbscrews at the perimeter of the faulty AW-001038 assembly (located at the rear of AC power tray 1). (See Figure 4-11.)

Figure 4-11. Unscrewing the AW-001038 Assembly from the AC Power Backplane



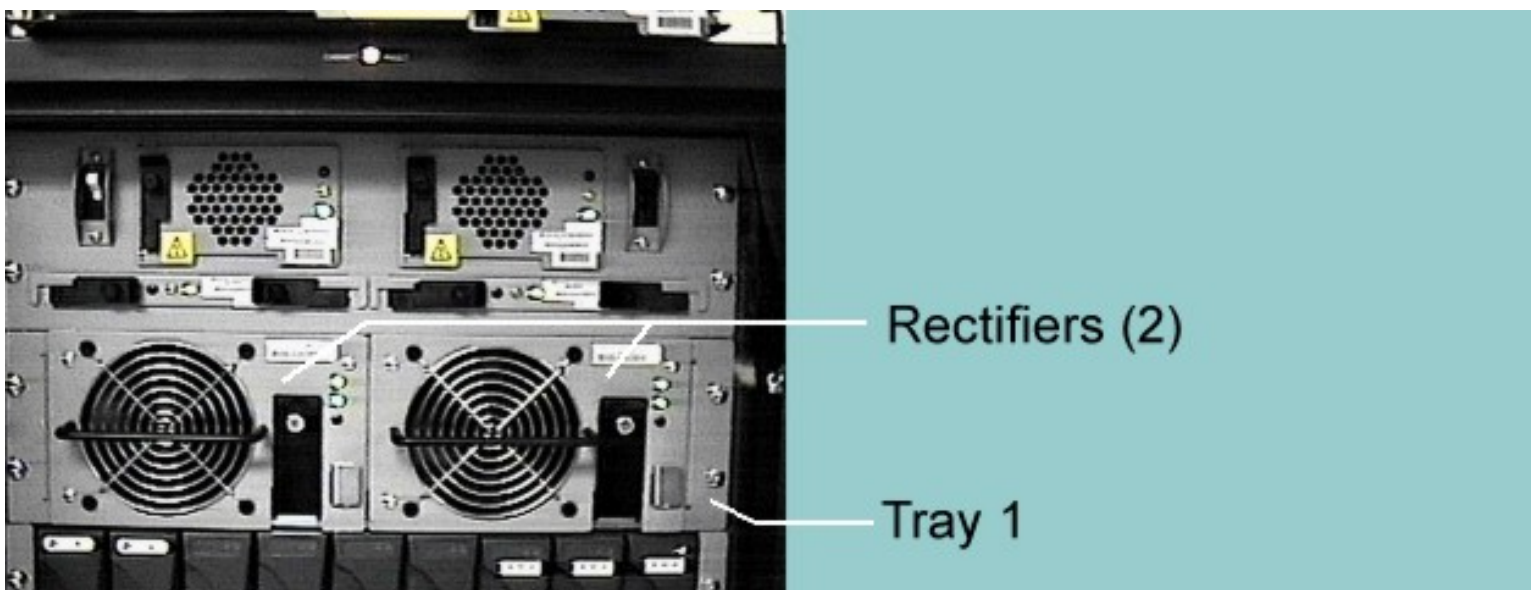
11. Carefully push the PCI/suitcase chassis a few inches forward until there is enough space to access and remove the 6-wire multicolored suitcase power cable from the left or right side of the cabinet (depending on which side is faulty). (See Figure 4-12.) The entire AW-001038 assembly is now detached.

Figure 4-12. Accessing the Suitcase Power Cable

Replacement Note: When installing the replacement suitcase power cable, carefully route the cable along the cabinet frame so that when the PCI/suitcase chassis is pushed back into place, it will not pinch the cable.

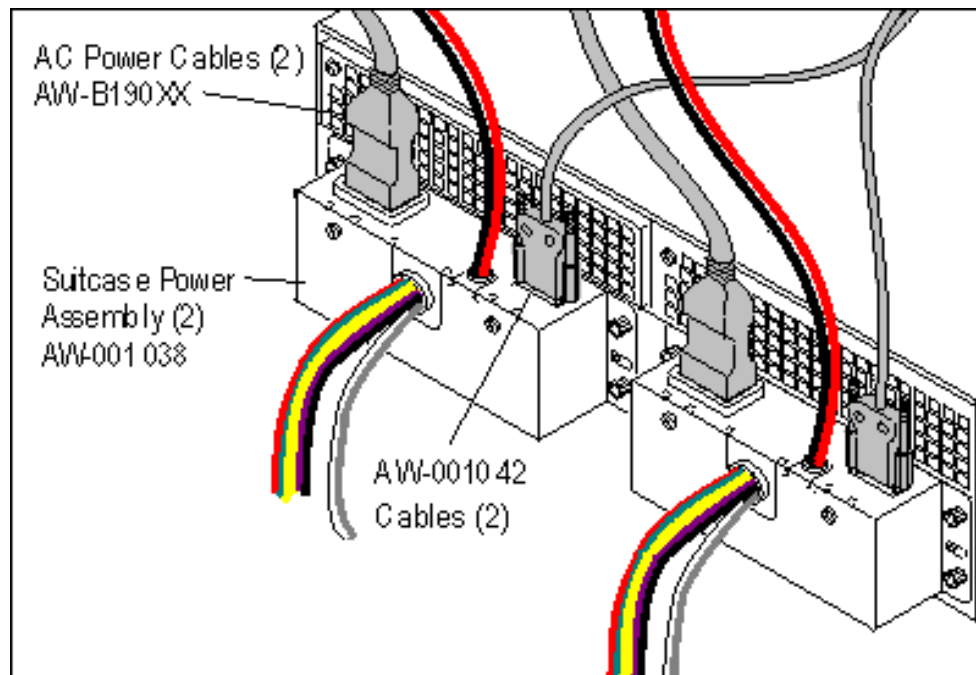
4.5.2 Tray 1 (Power Front End) AA-P28200

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Standing at the front of the cabinet, remove both the rectifiers (CRUs) from Tray 1. (See Figure 4-13.)

Figure 4-13. Removing Rectifiers from Tray 1

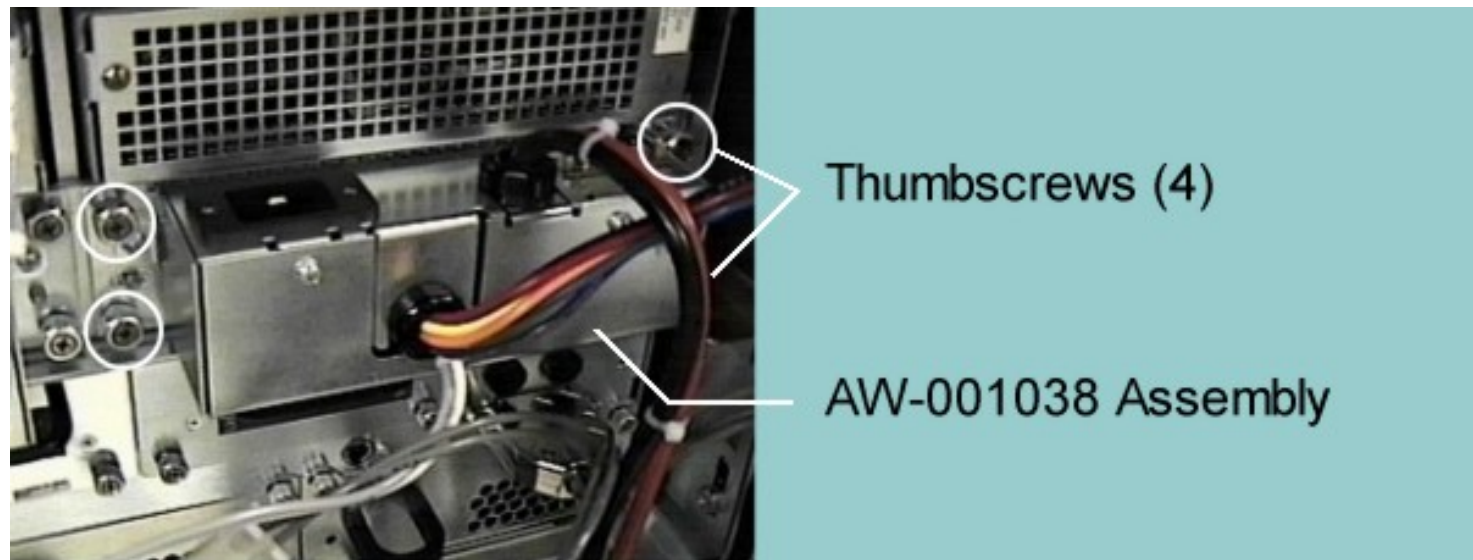
4. Unplug both the AC power cables (AW-B190XX) from their external plugs.
5. Open the cabinet rear door.
6. (See Figure 4-14.) From both the suitcase power cable assemblies (AW-001038) unplug:
 - The AC power cables (AW-B190XX) (one on each of the two suitcase power cable assembly boxes)
 - The AW-001042 cables (one on each of the two suitcase power cable assembly boxes)

Figure 4-14. Removing Cables from the AW-001038 Assembly



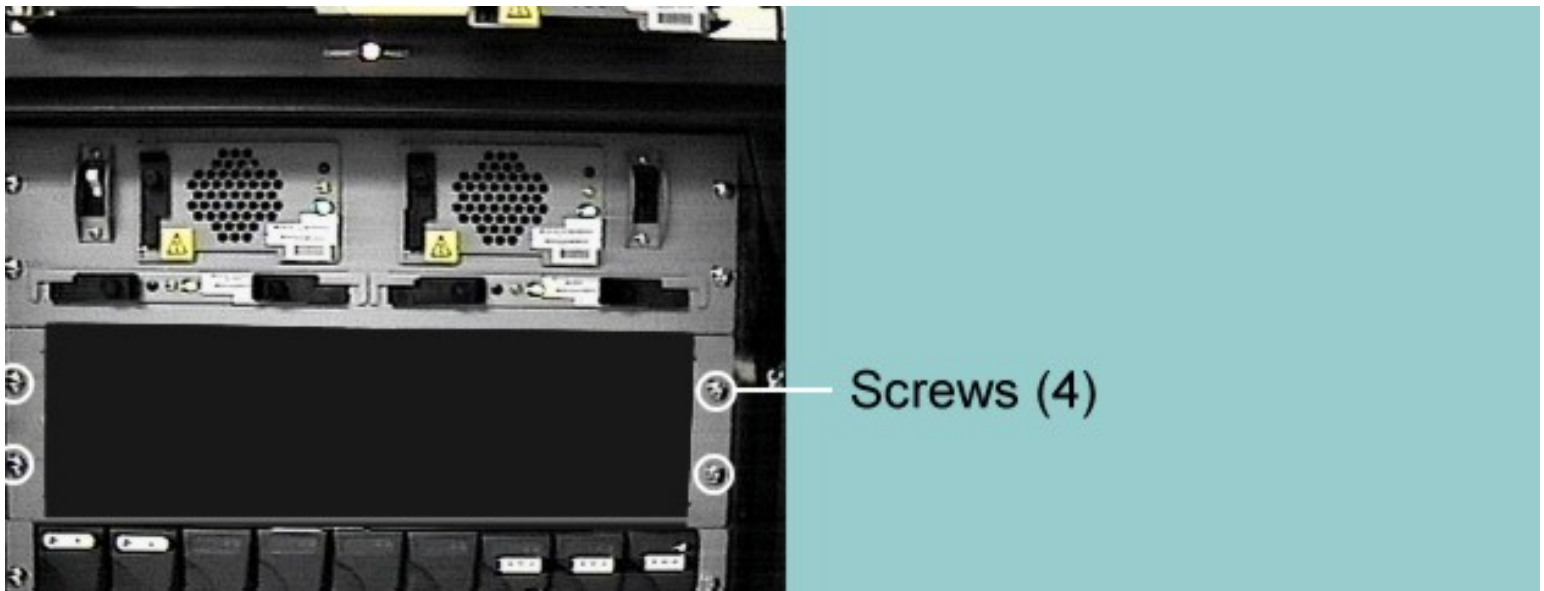
7. Remove the major four thumbscrews at the perimeter of the both the AW-001038 suitcase power cable assemblies (located at the rear of AC Power Tray 1). (See Figure 4-15.)

Figure 4-15. Unscrewing the AW-001038 Assembly from the AC Power Backplane



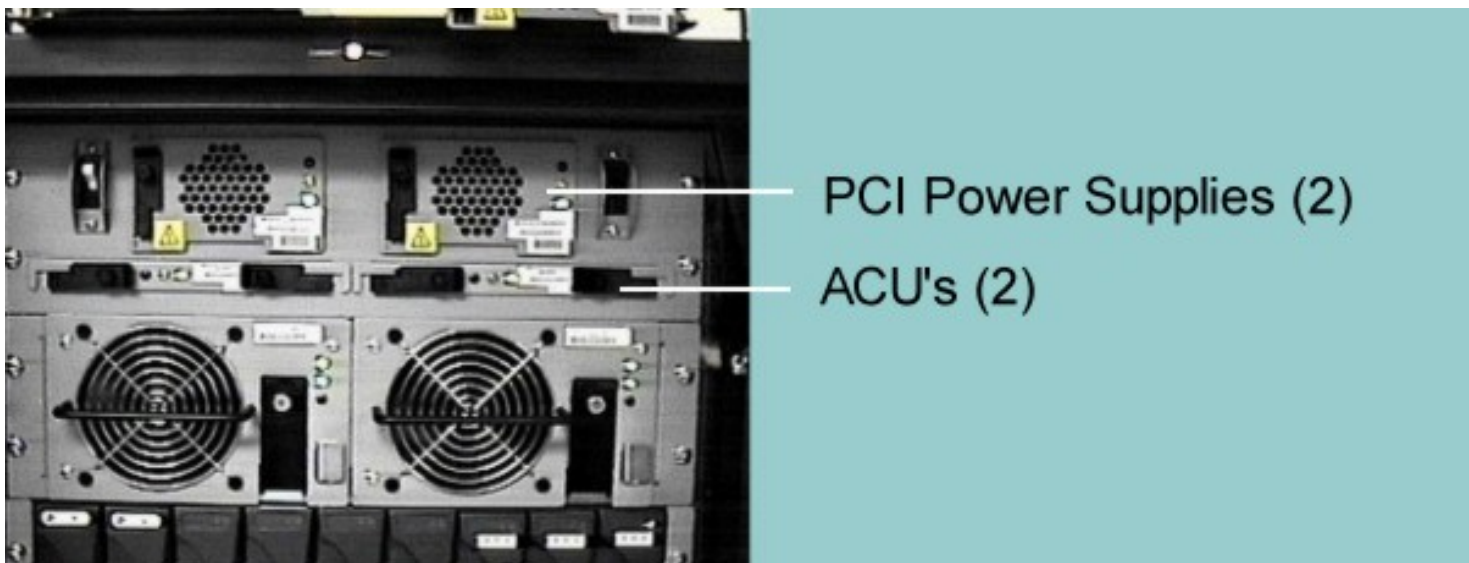
Note: you will need to support the suitcase power cable assembly (AW-001038) at this point to make sure that its attached cables are not strained.

8. At the cabinet front, unscrew the four screws (two on either side) securing Tray 1. Carefully pull Tray 1 forward to remove it. (See Figure 4-16.)

Figure 4-16. Removing Tray 1 from the Cabinet

4.5.3 Tray 2 (PCI/ACU Power Tray) AA-P28300

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Standing at the front of the cabinet, unscrew and remove both the PCI power supplies and ACU's (CRUs) from Tray 2. (See Figure 4-17)

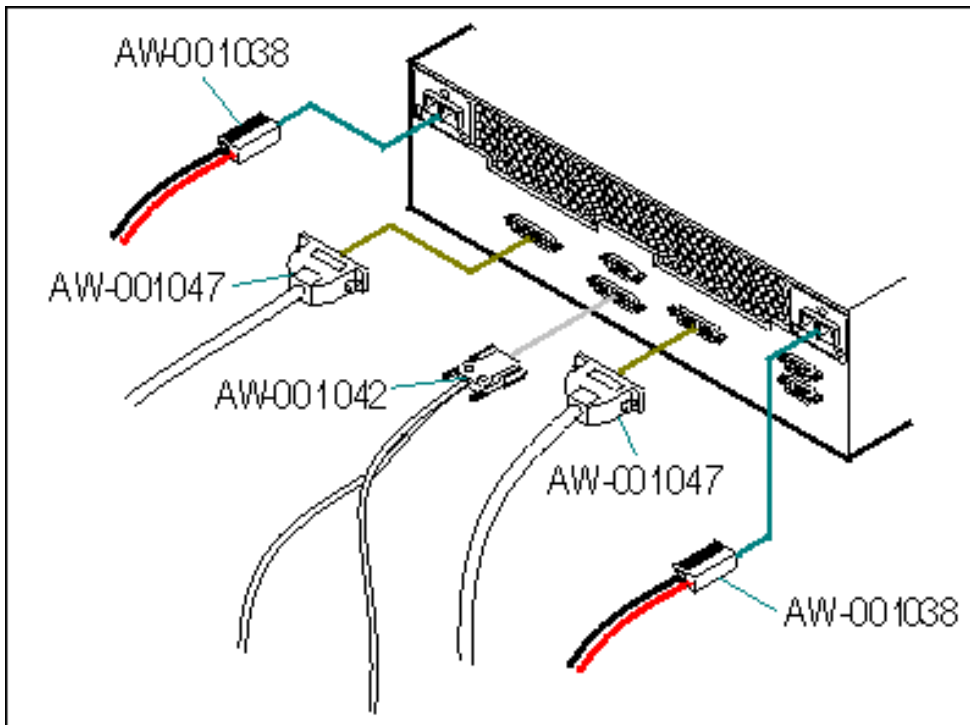
Figure 4-17. Removing PCI Power Supplies and ACU's from Tray 2

4. Open the cabinet rear door.
5. (See Figure 4-18) From the Tray 2 backplane, unscrew the following connectors using a small standard screwdriver:
 - Two AW-001047 cables from J008 and J009
 - One AW-001042 cable from J010
 - Two red/black cables, part of the CPU/Suitcase Power Assembly (AW-001038) from the top left and right of

the Power Tray 2 backplane

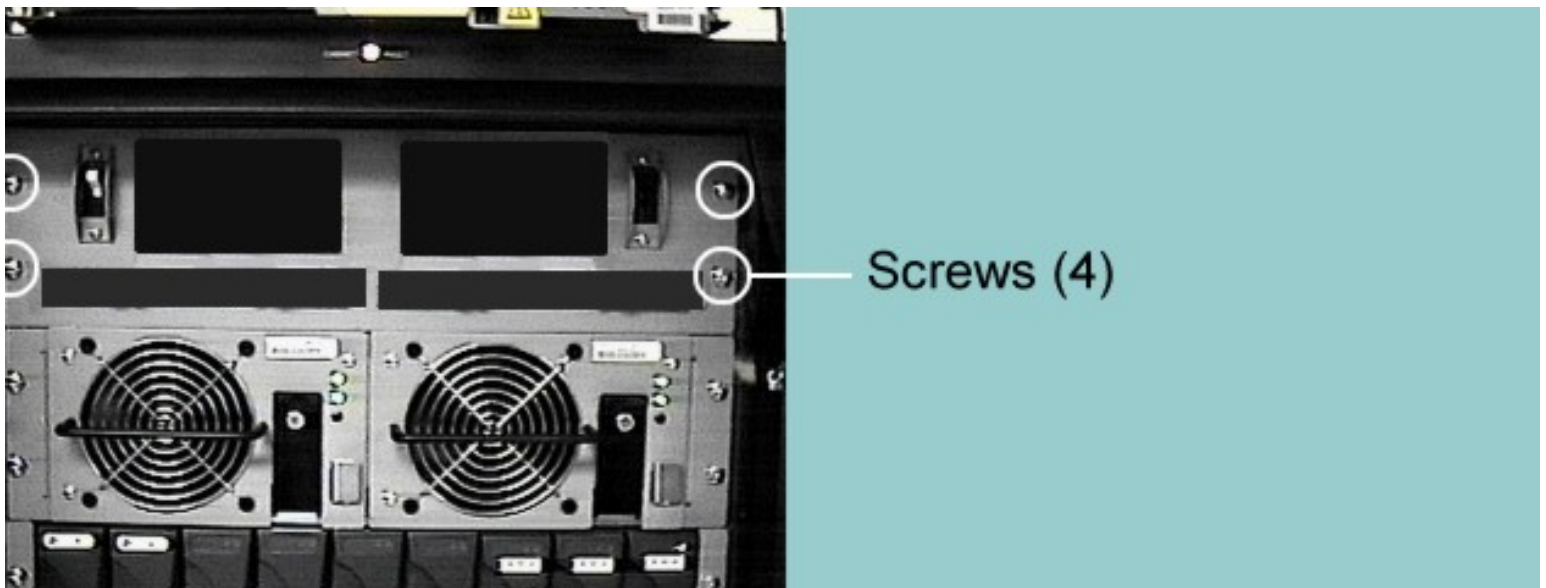
- One ACU/CPU to fault display cable (AW-001048) from J007

Figure 4-18. Tray 2 Backplane



6. At the cabinet front, unscrew the four screws (two on either side) securing Tray 2 and carefully pull Tray 2 forward to remove it. (See Figure 4-19.)

Figure 4-19. Removing the Screws from Tray 2 Front



4.5.4 CPU Backplane (AA-E25800)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)

3. Remove the two suitcases (CRUs) from the cabinet.

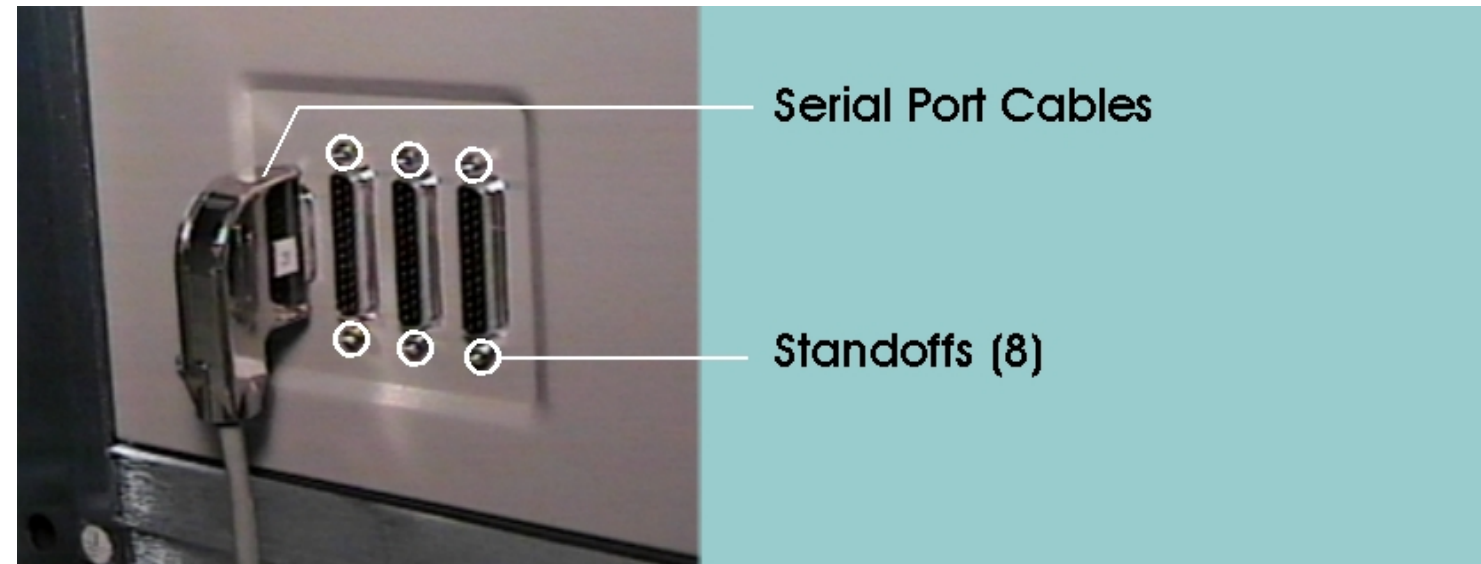
4. Open the cabinet rear door.

Refer to Figure 4-20 when performing the following steps.

5. Remove the cables from the serial ports on the CPU backplane cover.

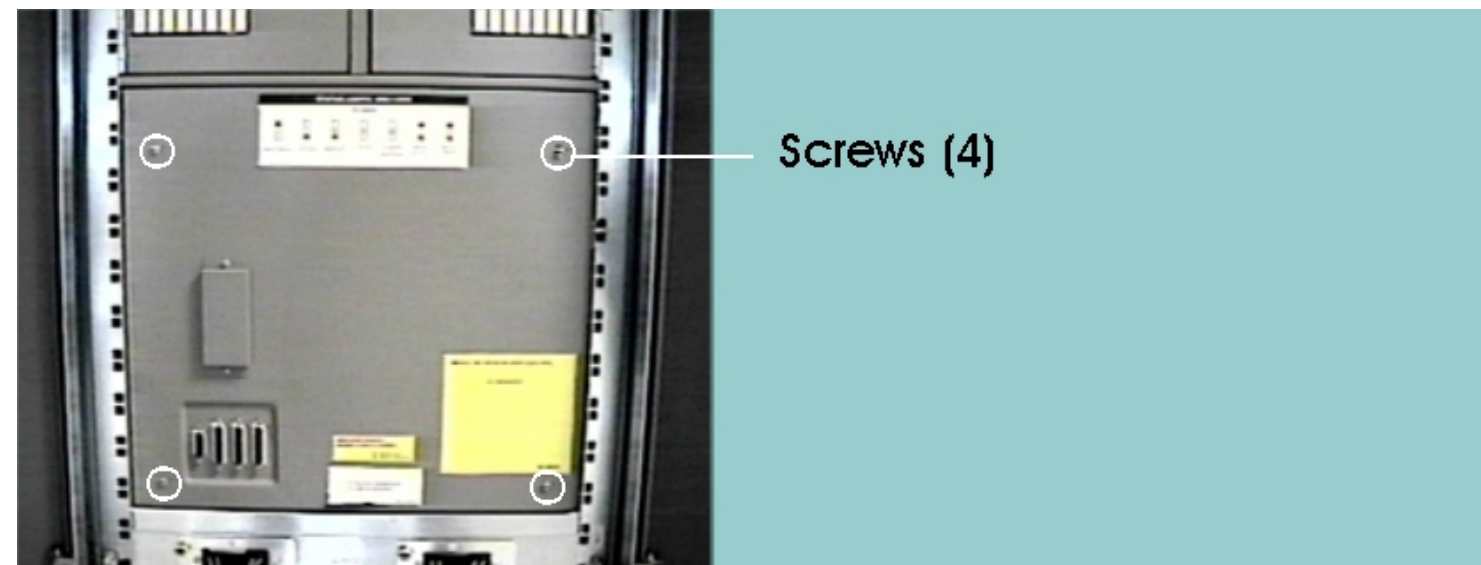
6. Using a 3/16" nut driver, remove the standoffs on the four serial ports.

Figure 4-20. Removing the Cables and Standoffs from the CPU Backplane



7. Remove the four screws securing the cover to the CPU backplane. (See Figure 4-21.)

Figure 4-21. Removing the Screws from the CPU Backplane Cover

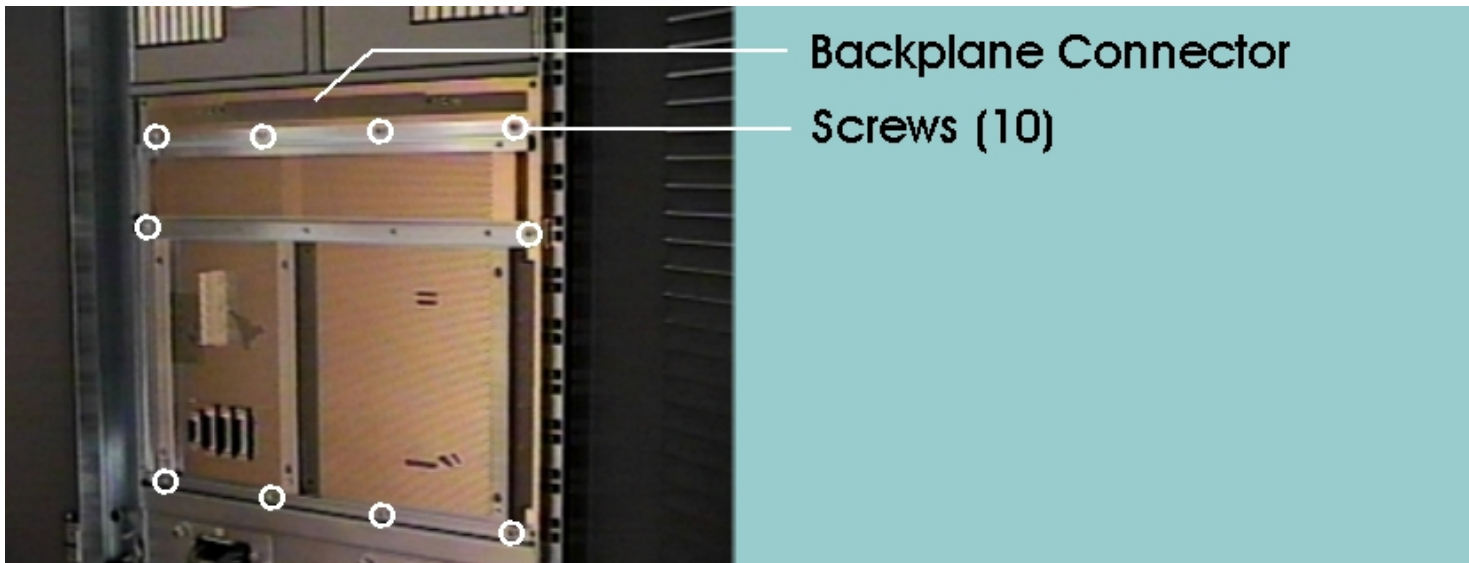


Refer to Figure 4-22 when performing the following steps.

8. Remove the 10 screws (four each in the upper and lower brackets, two in the center bracket) securing the CPU backplane.

NOTE: The upper and lower brackets are removable. The center bracket is fixed.

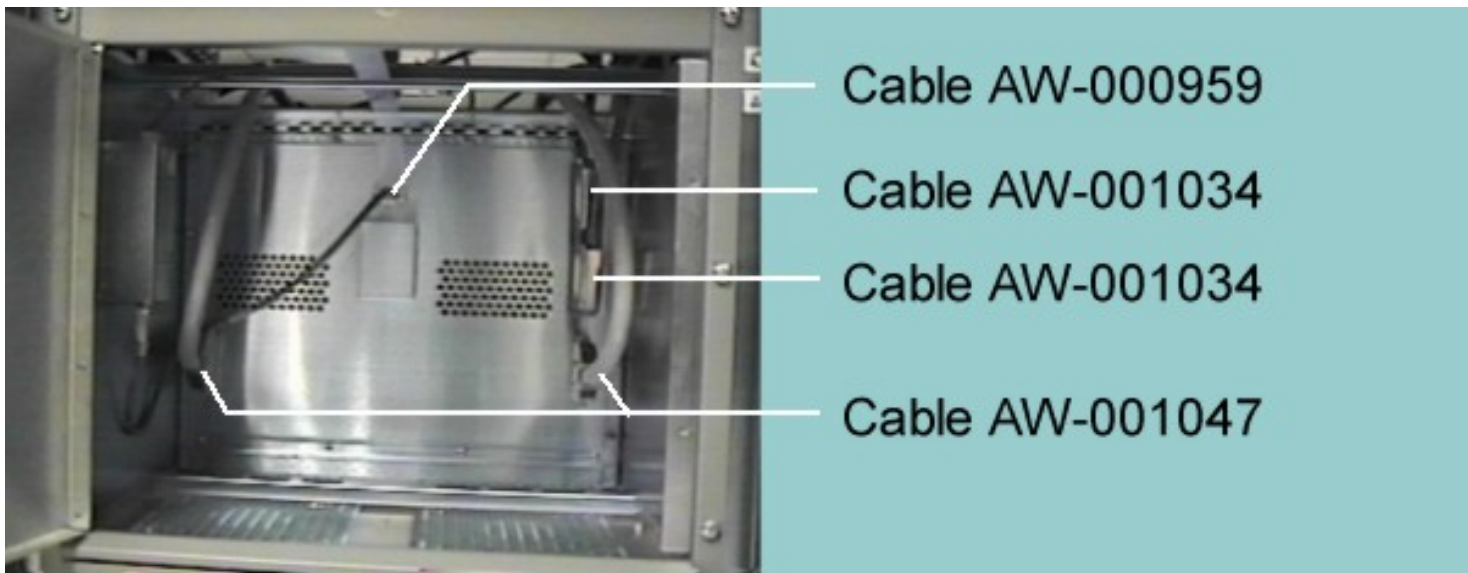
9. Pull the CPU backplane straight out from its connector (located at the top center).

Figure 4-22. Removing the CPU Backplane

4.5.5 PCI Backplane (AA-E26100)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Open the cabinet rear door and open the left PCI card cage door. Remove all the PCI cards (CRUs) from the left side of the PCI card cage. Label all the cables as you remove them from the cards. Close the left PCI card cage door.
4. Open the right PCI card cage door. Remove all the PCI cards (CRUs) from the right side of the PCI card cage. You may need to use a torx head wrench tool set (star hex tool) to open the PCI card cage. Label all the cables as you remove them from the cards. Close the right PCI card cage door.
5. At the front of the cabinet, open the access door to the PCI backplane. (See Figure 4-2.)
6. Disconnect the following cables from the PCI backplane: (See Figure 4-23.)
 - AW-001047
 - AW-000959
 - AW-001034 (2)

Figure 4-23. Disconnecting the Cables from the PCI Backplane



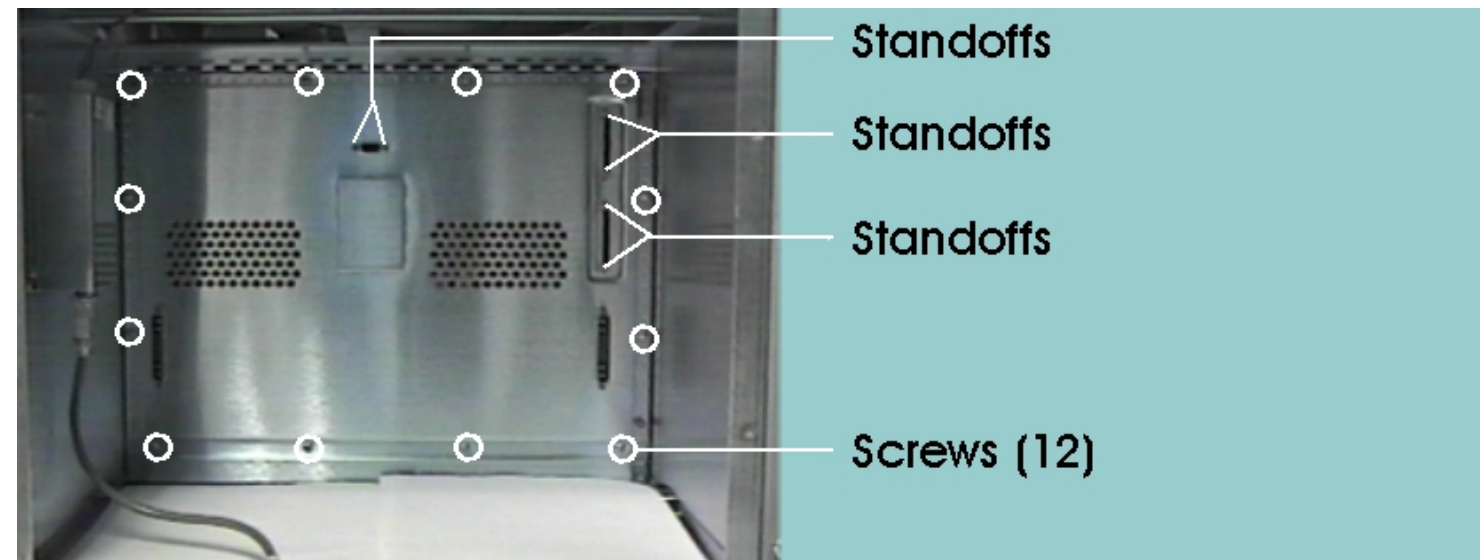
NOTE: Place a drop cloth or sheets of paper over the top of the suitcases to prevent hardware from falling into them during the next steps.

Refer to Figure 4-24 when performing the following steps.

7. Using a 3/16" nut driver, remove the standoffs from the three connectors on the PCI backplane EMI shield.

8. Remove the 12 screws securing the EMI shield to the PCI backplane.

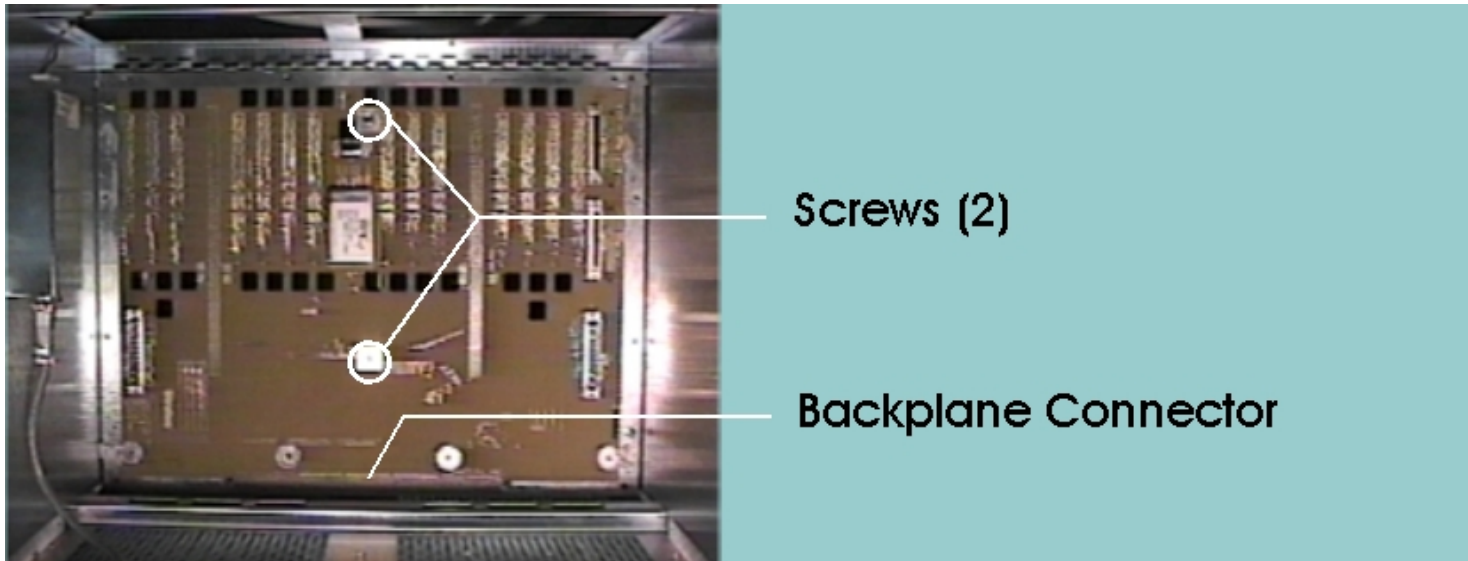
Figure 4-24. Removing the Standoffs and Screws from the PCI Backplane EMI Shield



Refer to Figure 4-25 when performing the following steps.

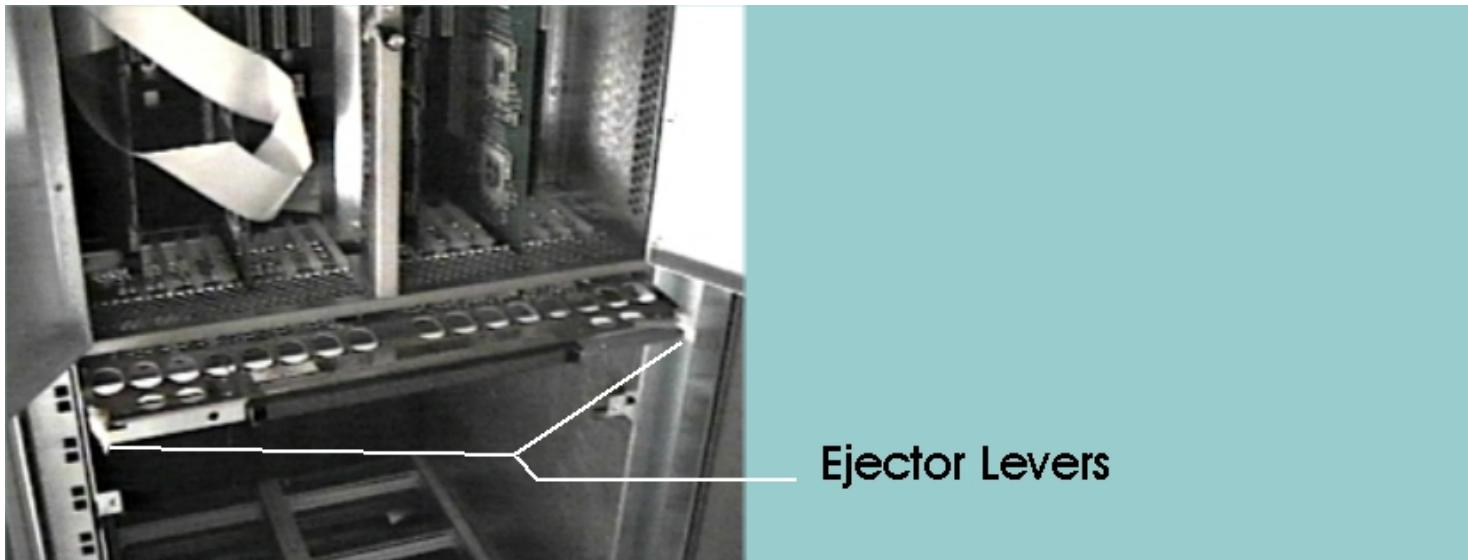
9. Remove the two screws securing the PCI backplane to the divider panel.

10. Carefully pull the PCI backplane straight out from its connector (located at the bottom center) and remove it from the cabinet.

Figure 4-25. Removing the PCI Backplane

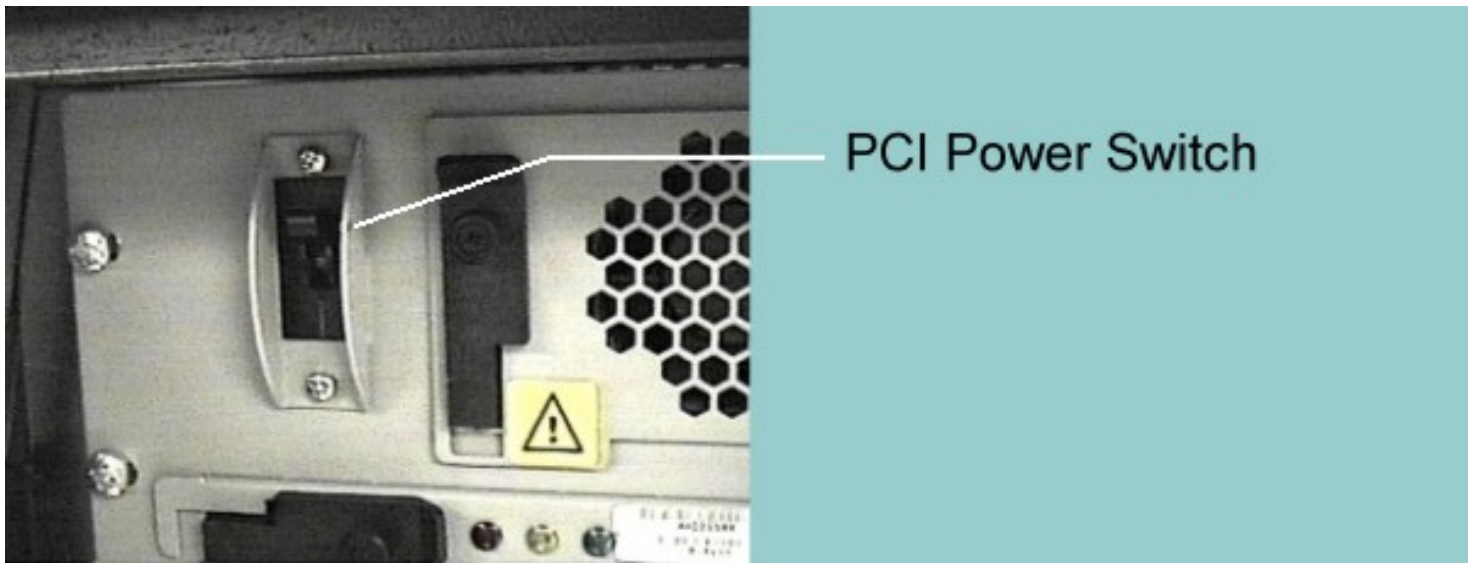
4.5.6 Backplane Interconnect PCB (AA-E26200)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Remove the CPU backplane. (Refer to the CPU Backplane (AA-E25800) removal procedure.)
4. Open the two ejector levers on the sides of the backplane interconnect PCB and slide it out of the cabinet. (See Figure 4-26.)

Figure 4-26. Removing the Backplane Interconnect PCB

4.5.7 PCI Fault Display PCB (AA-E26600)

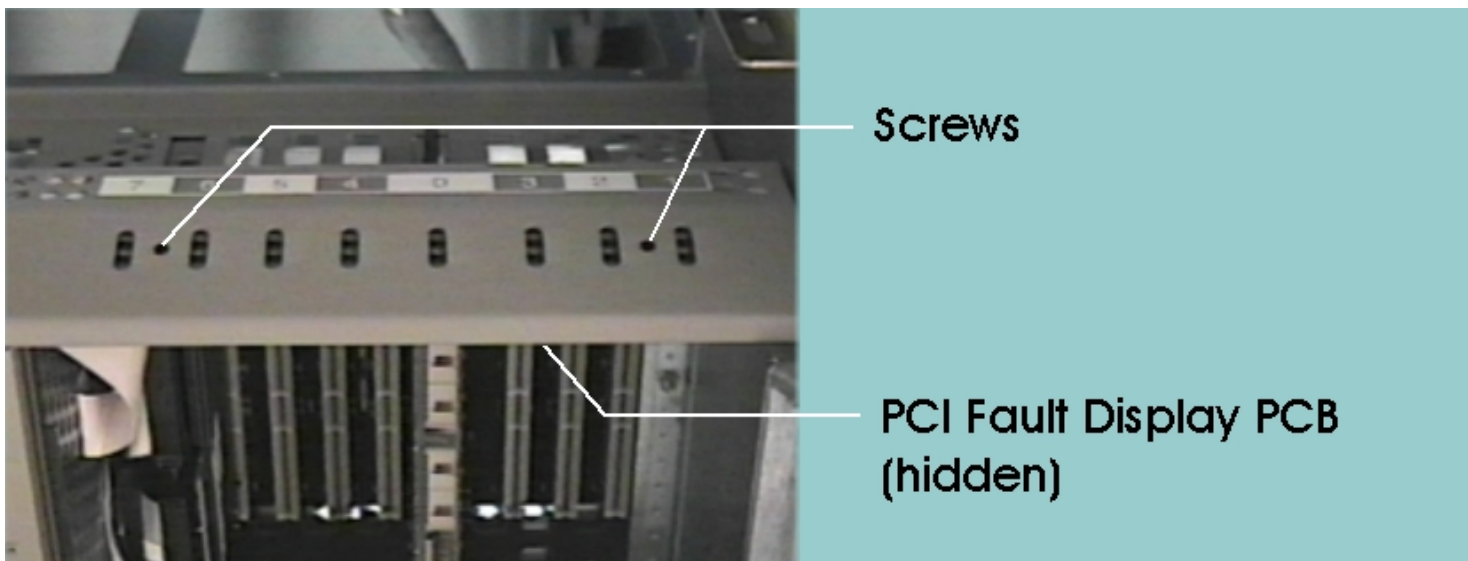
1. Open the cabinet front door.
2. Turn off the switch on the PCI power supply that provides power to the side of the cabinet where the failed PCI fault display is located (the switch is located on the sides of Tray 2). (See Figure 4-27)

Figure 4-27. PCI Power Switch

3. Open the cabinet rear door.

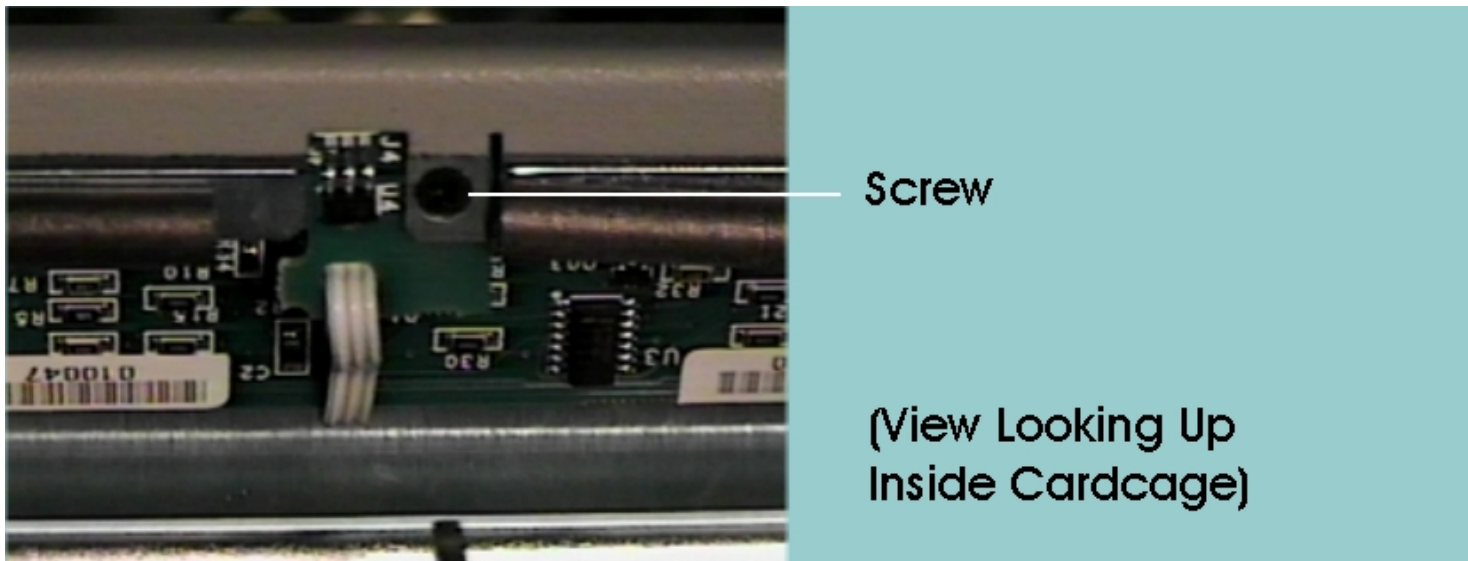
NOTE: There are two PCI fault display PCBs. Each one is secured to the panel at the top of the card cage (containing card cage slot numbers and LEDs) with three screws, two of which are secured at the top of the panel, and the other at the bottom.

4. Open the card cage door on the side where the failed PCI fault display PCB is located.
(See Figure 4-2.)
5. Remove the two top screws securing the failed PCI fault display PCB to the panel.
(See Figure 4-28.)

Figure 4-28. Removing the Top Screws from the PCI Fault Display PCB

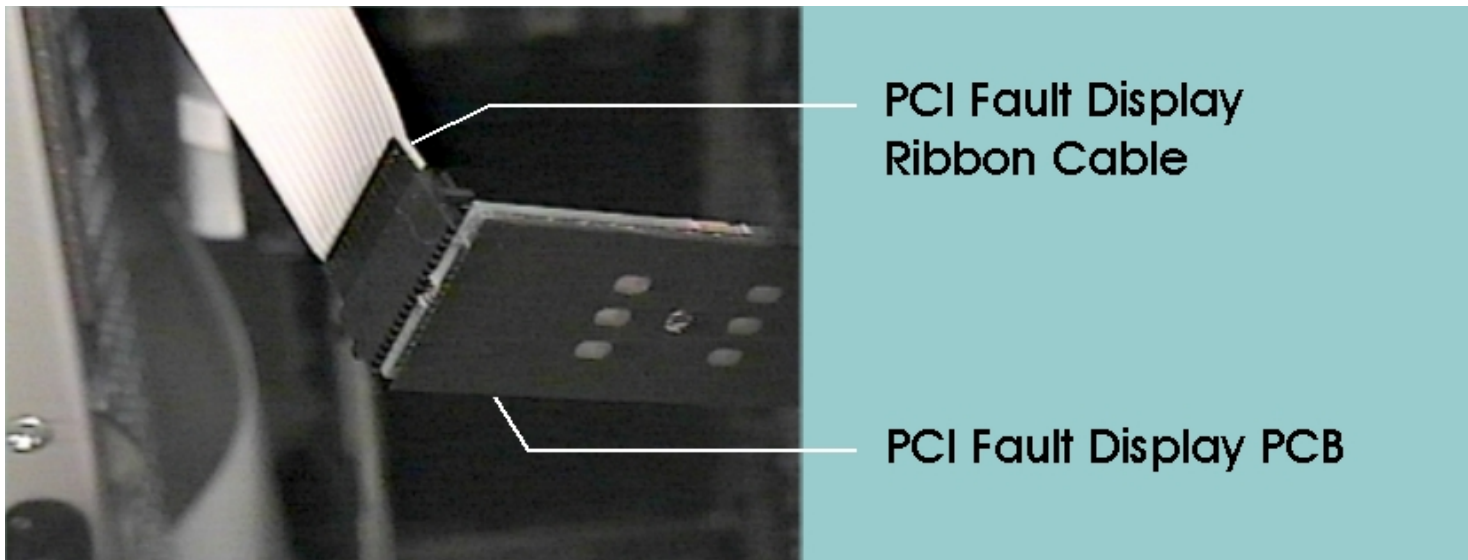
6. Remove the bottom screw securing the failed PCI fault display PCB to the panel. (See Figure 4-29.)

Figure 4-29. Removing the Bottom Screws from the PCI Fault Display PCB



7. Disconnect the PCI fault display PCB from the ribbon cable. (See Figure 4-30.)

Figure 4-30. Disconnecting the PCI Fault Display PCB from the Ribbon Cable



4.5.8 Cabinet Fault Display PCB (AA-E26500)

NOTE: There are two cabinet fault display PCBs. One is located behind the PCI card cage and the other is in the cabinet top cover.

Cabinet Fault Display PCB (behind PCI card cage)

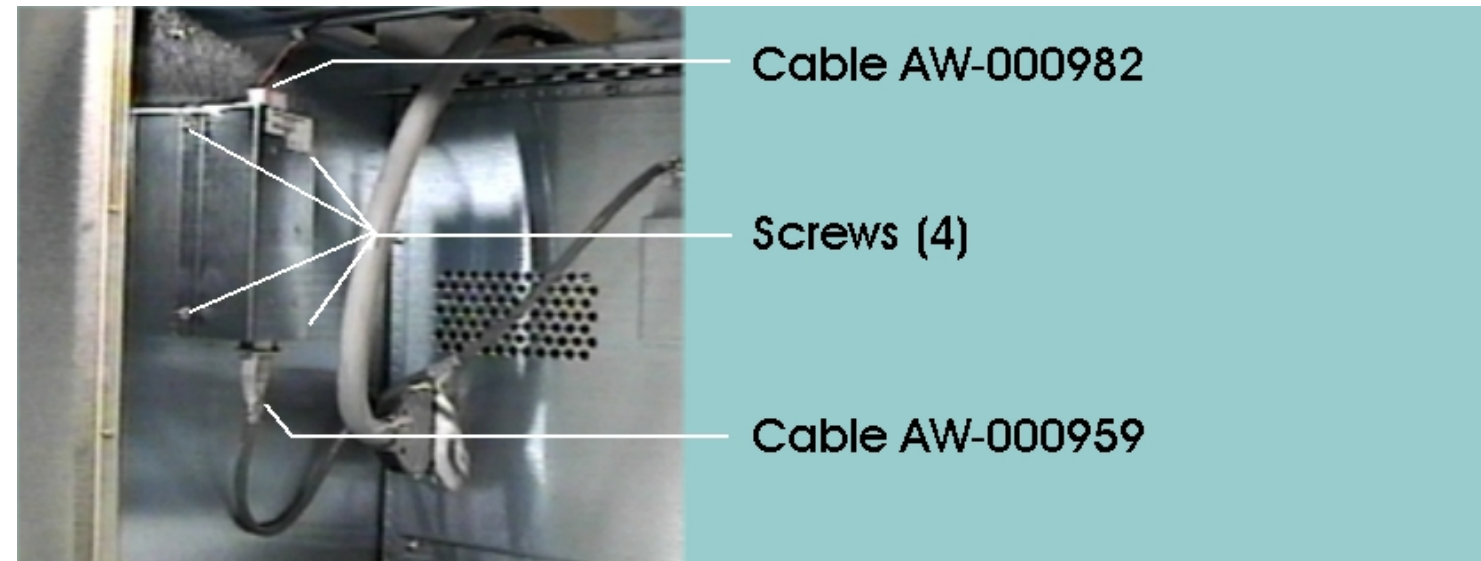
1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Open the cabinet front door.
4. Open the access door to the PCI backplane. (See Figure 4-3.)

Refer to Figure 4-31 when performing the following steps.

NOTE: Before performing the next step, place a sheet of paper over the left suitcase to prevent any screws from falling into the suitcase.

5. Disconnect the AW-000959 and AW-000982 cables from the cabinet fault display PCB.
6. Remove the four screws securing the cabinet fault display PCB to the chassis.

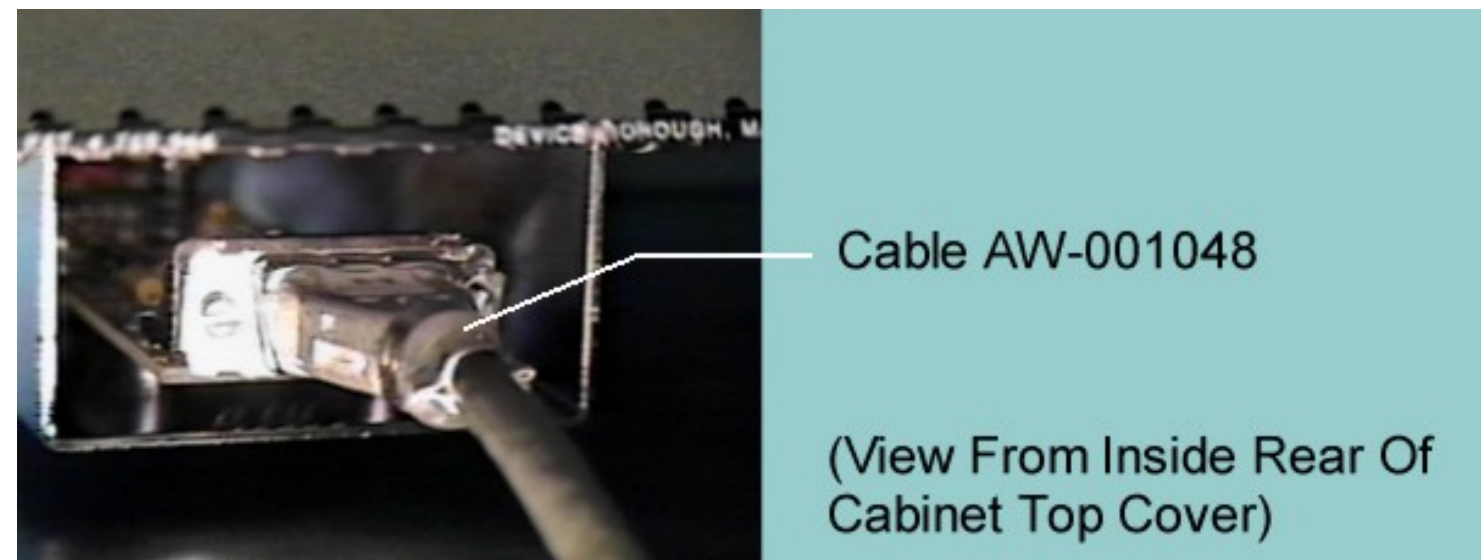
Figure 4-31. Disconnecting Cables and Removing Screws from the Cabinet Fault Display PCB



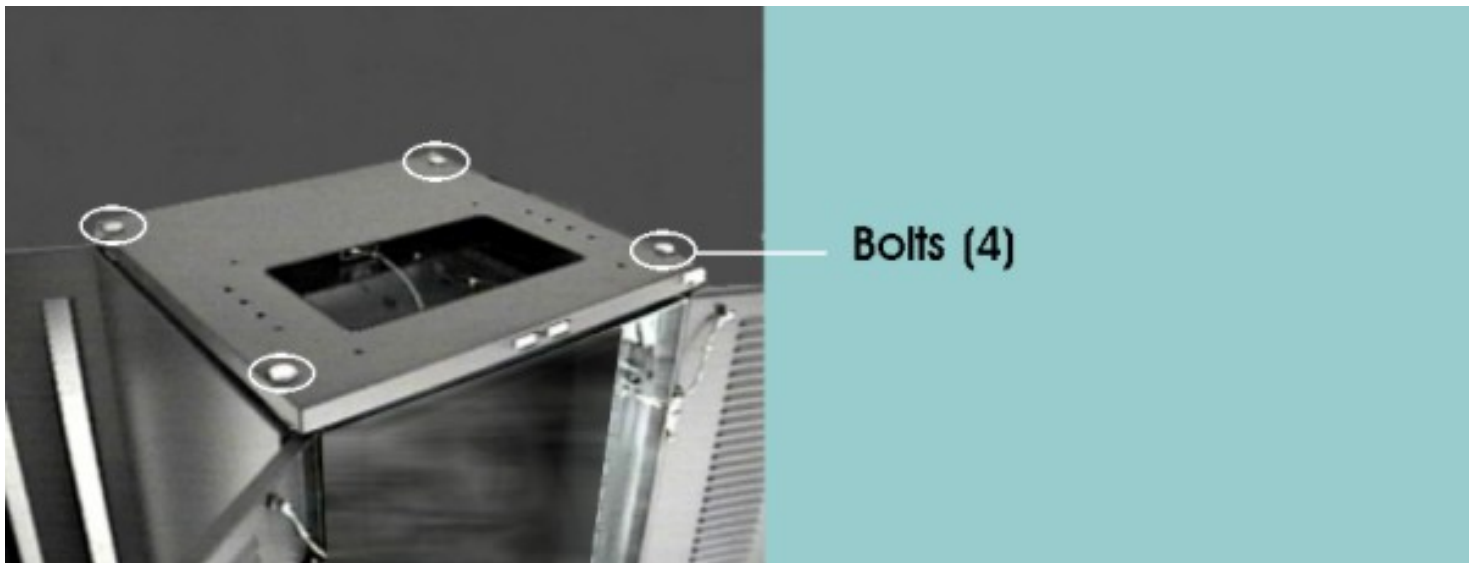
Cabinet Fault Display PCB (inside cabinet top cover)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Open the cabinet rear door.
4. At the top of the cabinet, remove the AW-001048 cable from the cabinet fault display PCB. (See Figure 4-32.)

Figure 4-32. Disconnecting the Cable from Cabinet Fault Display PCB

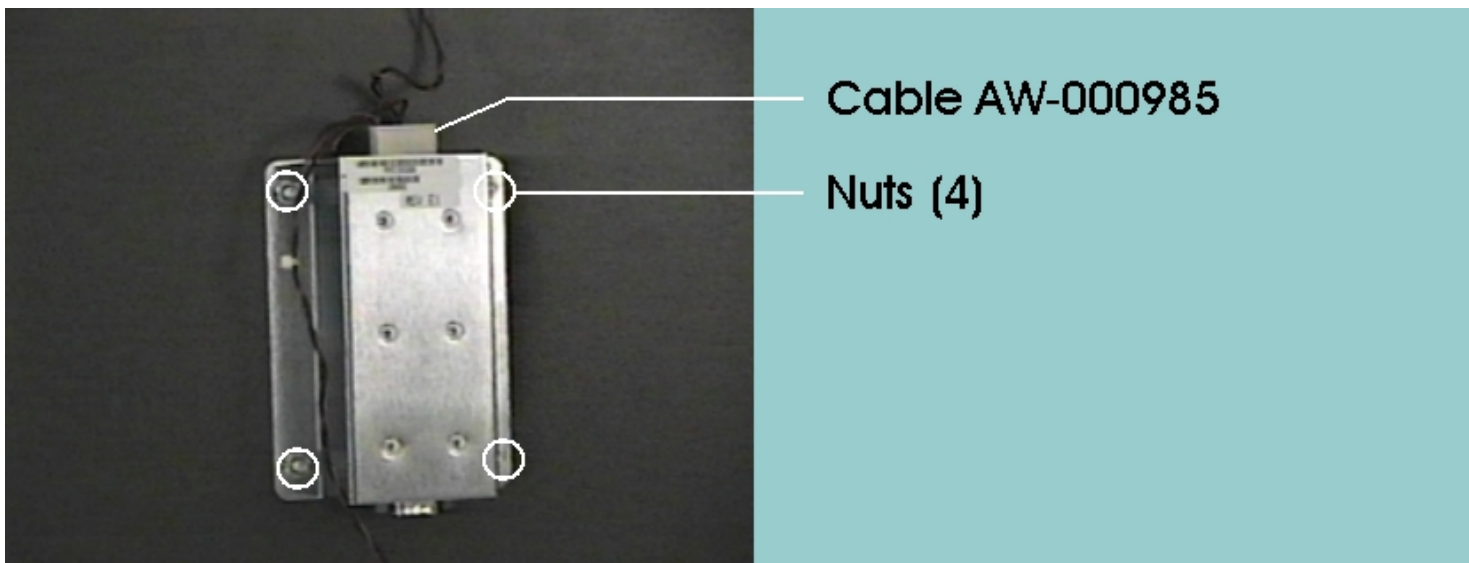


5. Using pliers or a 15/16" open end wrench, remove the four bolts securing the cabinet top cover and then remove the cover from the cabinet. (See Figure 4-33.)

Figure 4-33. Removing the Bolts from Cabinet Top Cover

Refer to Figure 4-34 when performing the following steps.

6. Using an 11/32" nut driver, remove the four nuts securing the cabinet fault display PCB to the top cover.
7. Disconnect the AW-000985 cable from the cabinet fault display PCB (at the top of the cabinet).

Figure 4-34. Removing the Nuts and Disconnecting the Cable from the Cabinet Fault Display PCB

4.5.9 Disk Shelf, SCSI (AA-D84000, AA-D84001)

AA-D84000 is the disk shelf with fans, SES and 48v DC Power Supplies;

AA-D84001 is the empty disk shelf-used for replacements

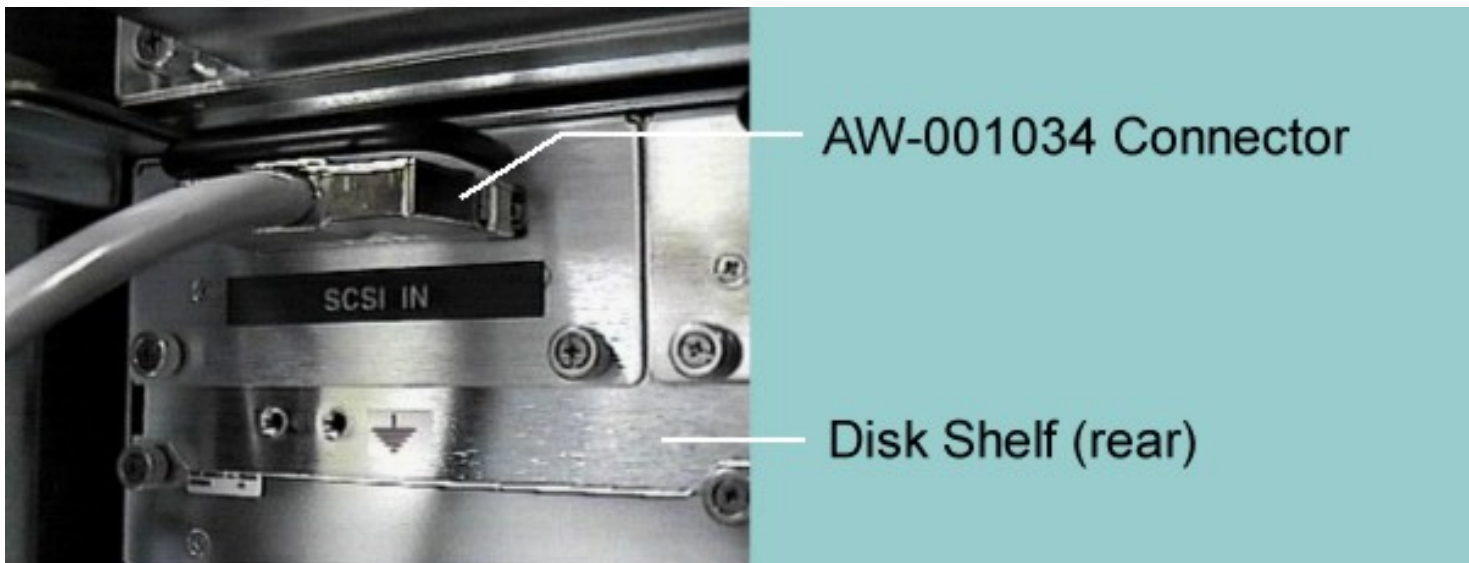
1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Open the cabinet rear door.
4. Disconnect the AW-001036 connectors from the appropriate disk shelf (at the rear of the disk shelf on the right).(See Figure 4-35)

Figure 4-35. Removing the AW-001036 Cable from the Disk Shelf Backplane



5. Disconnect the AW-001034 cable from the appropriate disk shelf (at the rear of the disk shelf on the left in the SE-SE I/O repeater module). (See Figure 4-36)

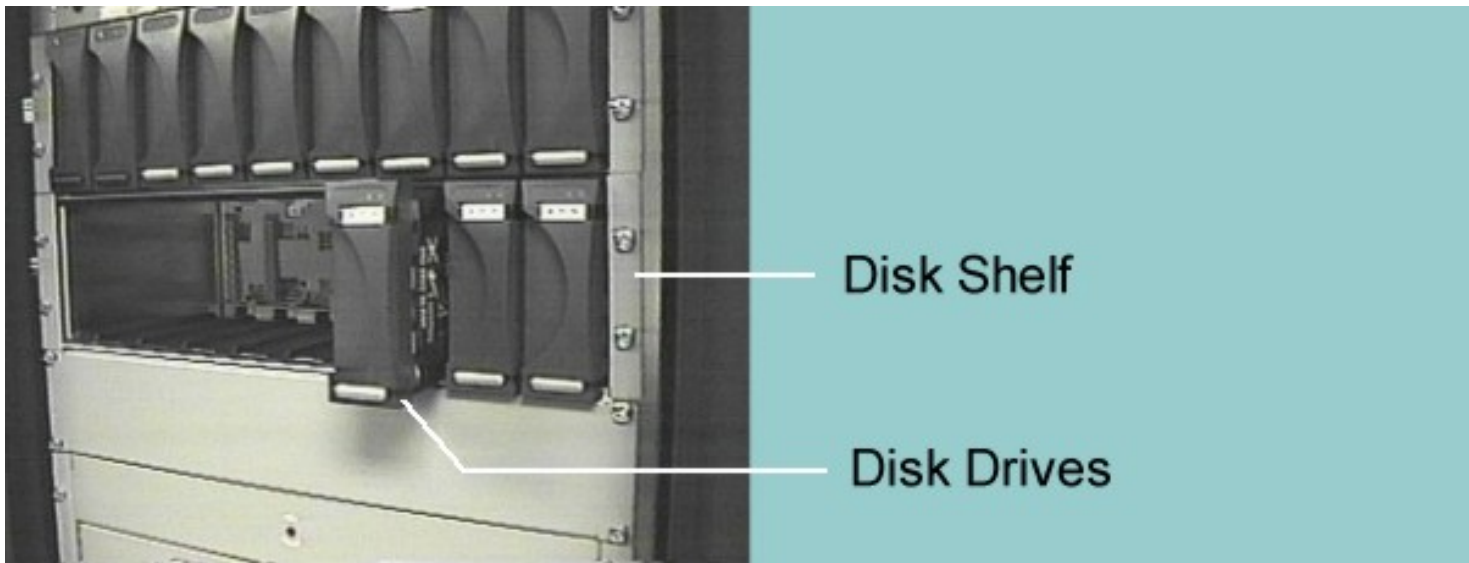
Figure 4-36. Removing the AW-001034 Cable from the Disk Shelf Backplane



6. Open the cabinet front door.

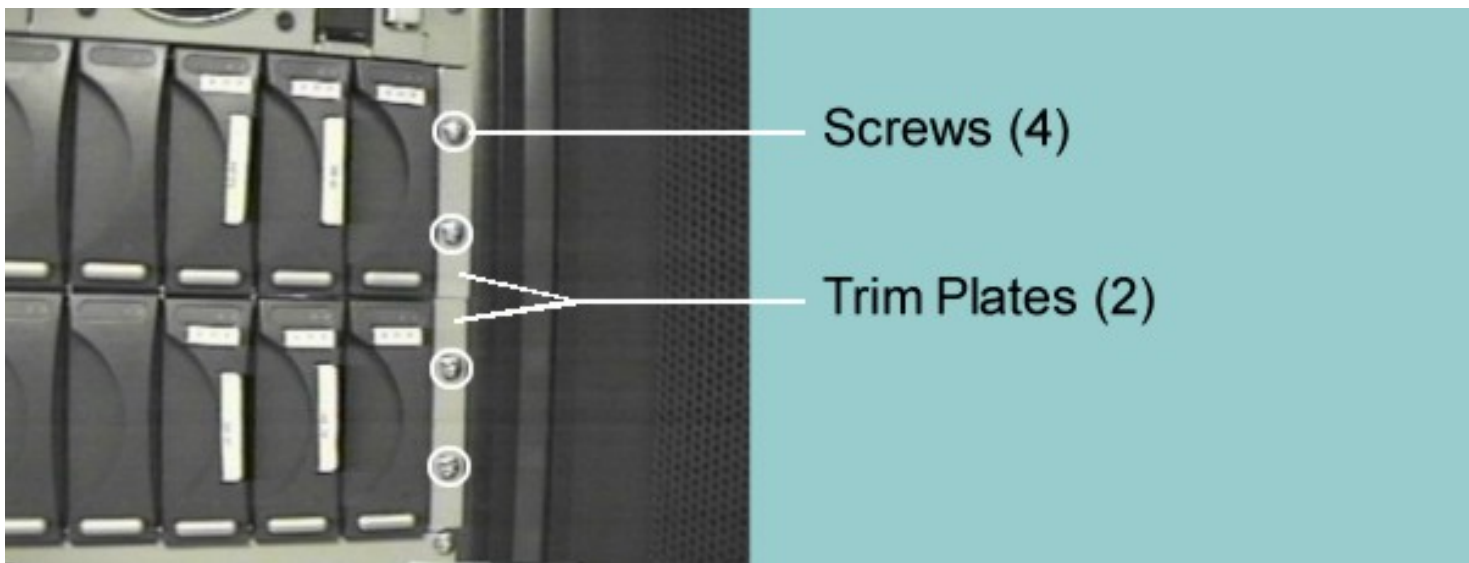
7. Standing at the front of the cabinet, remove all the disk power supplies and disk drives (CRUs) from the disk shelf. (See Figure 4-37.)

Figure 4-37. Disk Shelf with Partially Removed Disk Power Supplies and Disk Drives



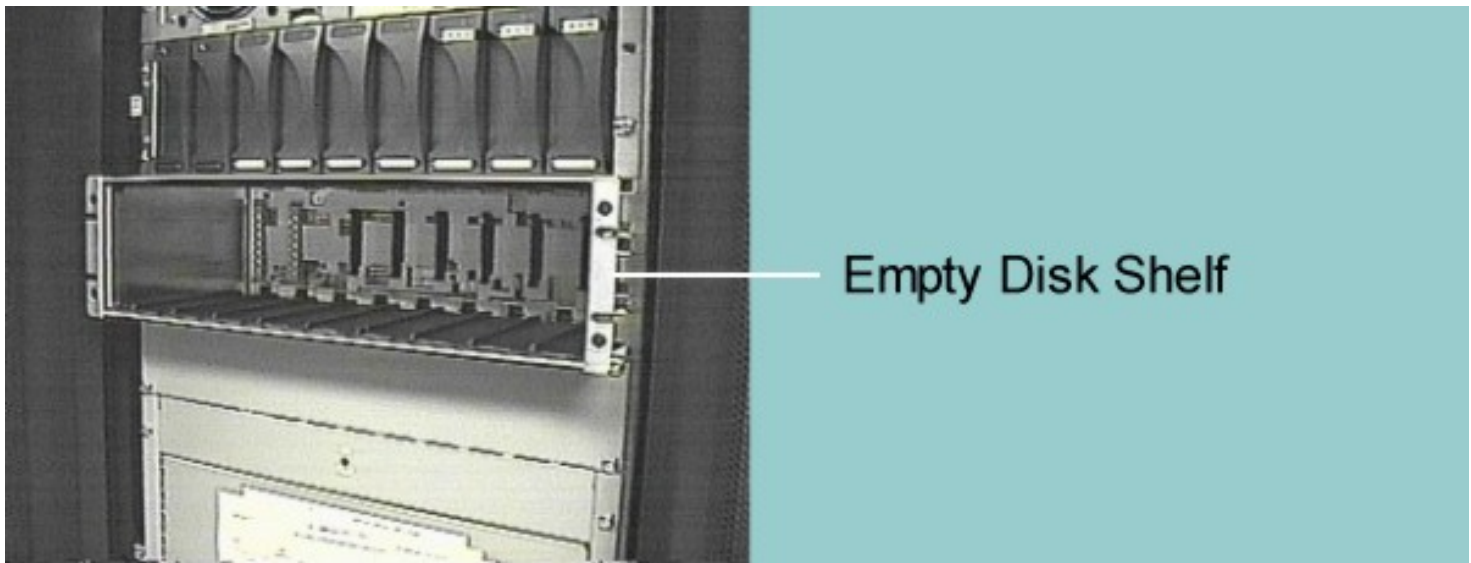
8. Remove the two screws in each of the four trim plates on both sides of the disk shelf. (See Figure 4-38.)

Figure 4-38. Removing the Trim Plates on the Left and Right Sides of the Disk Shelf



9. Standing at the rear of the cabinet, gently push the disk shelf forward to enable you get a good grasp of it from the front of the cabinet.
10. Standing at the front of the cabinet, carefully slide the disk shelf out of the cabinet. (See Figure 4-39.)

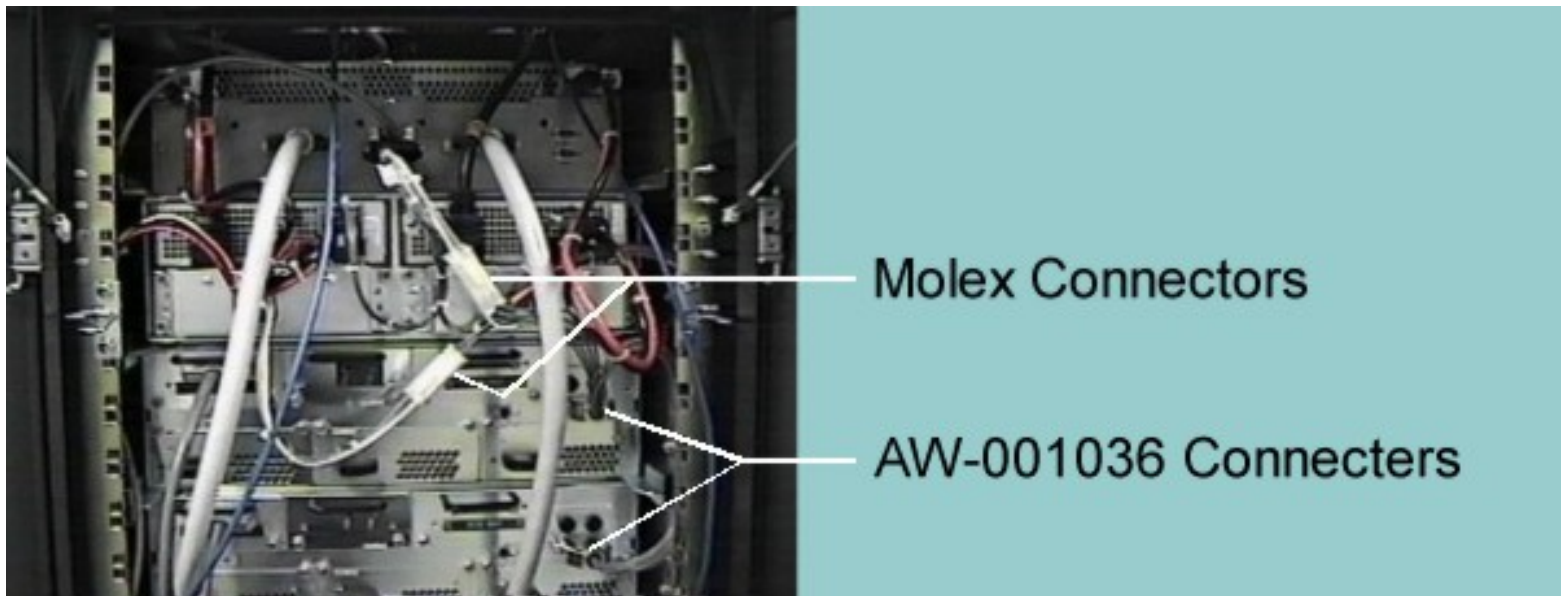
Figure 4-39. Removing the Disk Shelf



4.5.10. Disk Shelf Power Cable (AW-001036)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1)
3. Open the cabinet rear door.
4. Disconnect the faulty AW-001036 disk shelf power cable from both the Molex connectors (P2 and P3) connecting to AW-001038 which attaches to the AC power chassis). (See Figure 4-40.)

Figure 4-40. Disconnecting the Disk Shelf Power Cable from the Molex Connectors



5. Disconnect the faulty AW-001036 disk shelf power cable connector from the plug at the far right of the disk shelf rear. (See Figure 4-41.)

Figure 4-41. Disconnecting the Disk Shelf Power Cable from the Disk Shelf



4.5.10HS Hot Swap Replacement of Disk Shelf Power Cable (AW-001036)

1. At the cabinet front, pull PSU0 and PSU1 disk power supplies from the top disk shelf. (See Figure 4-42.)

Figure 4-42. Pulling the Disk Power Supplies from the Disk Shelf



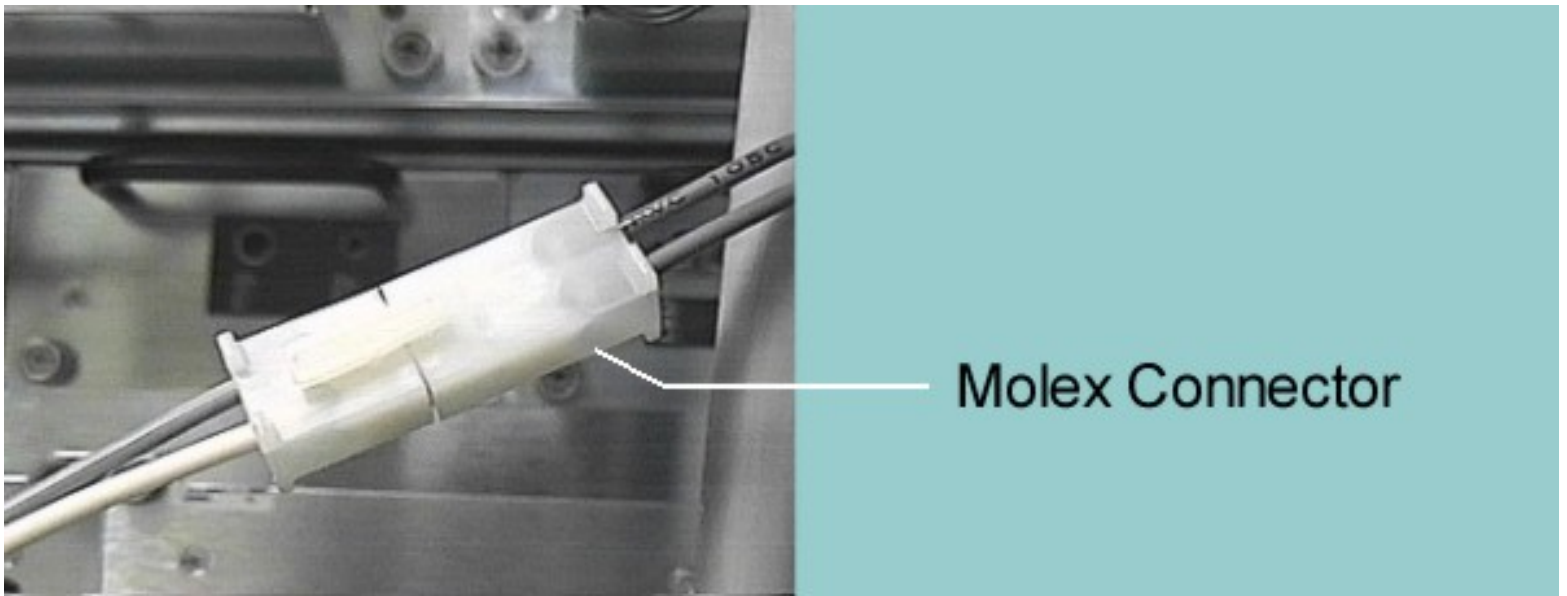
2. At the cabinet rear, unscrew the AW-001036 connector ("P2") from the top disk shelf (See Figure 4-43)

Figure 4-43. Unscrewing the AW-001036 Connector



3. Unplug the AW-001036 from one Molex connector (See Figure 4-44)

Figure 4-44. Unplugging the AW-001036 from the Molex Connector



Refer to the appropriate figures above for the following steps:

4. Plug the new AW-001036 replacement into the emptied Molex connector.
5. Screw the AW-001036 connector into the empty plug on the top disk shelf.

6. At the cabinet front, insert PSU0 and PSU1 disk power supplies back into the top disk shelf.
7. WAIT for the disk drives to mirror up (This may take several hours).
8. Pull PSU0 and PSU1 disk power supplies from the bottom disk shelf.
9. At the cabinet rear, unscrew the AW-001036 connector ("P1") from the bottom disk shelf and screw in the new AW-001036 connector.
10. Unplug the AW-001036 from the other end of the Molex connector and reconnect the new AW-001036 cable.
11. At the cabinet front, insert PSU0 and PSU1 disk power supplies back into the bottom disk shelf.

4.5.11. Disk Shelf SCSI Data Cable (AW-001034)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1)
3. Open the cabinet rear door.
4. Disconnect the failed disk shelf SCSI data cable (AW-001034) from the disk shelf (rear). (See Figure 4-45.)

Figure 4-45. Disconnecting the SCSI Data Cable from the Disk Shelf (rear)

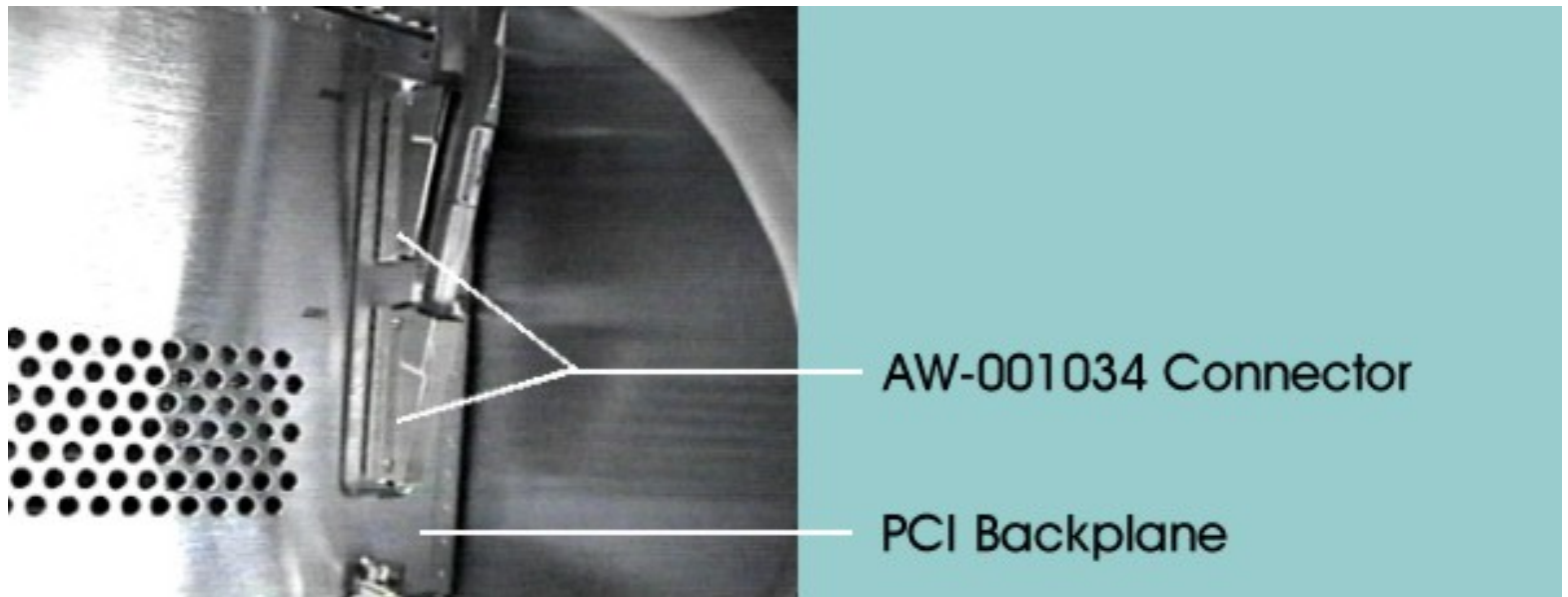


5. Open the cabinet front door.

6. Open the access door to the PCI backplane. (See Figure 4-3.)

7. Disconnect the other end of the disk shelf SCSI data cable (AW-001034) from the appropriate plug on the PCI backplane. (See Figure 4-46.)

Figure 4-46. Disconnecting the SCSI Data Cable from the PCI Backplane



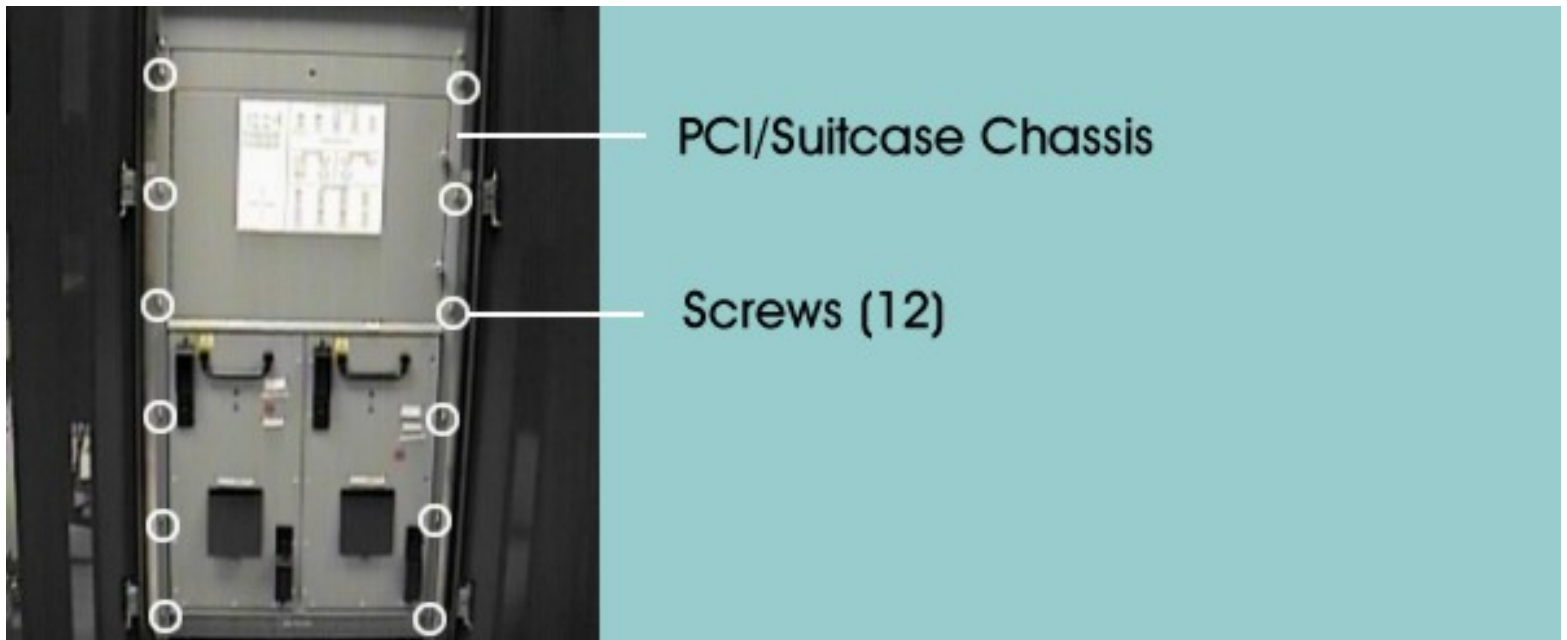
4.5.12 CPU Backplane Power Cable (AW-001048)

1. Shut down the system from the system console.

2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)

3. Remove the 12 screws securing the PCI/suitcase chassis. (See Figure 4-47.)

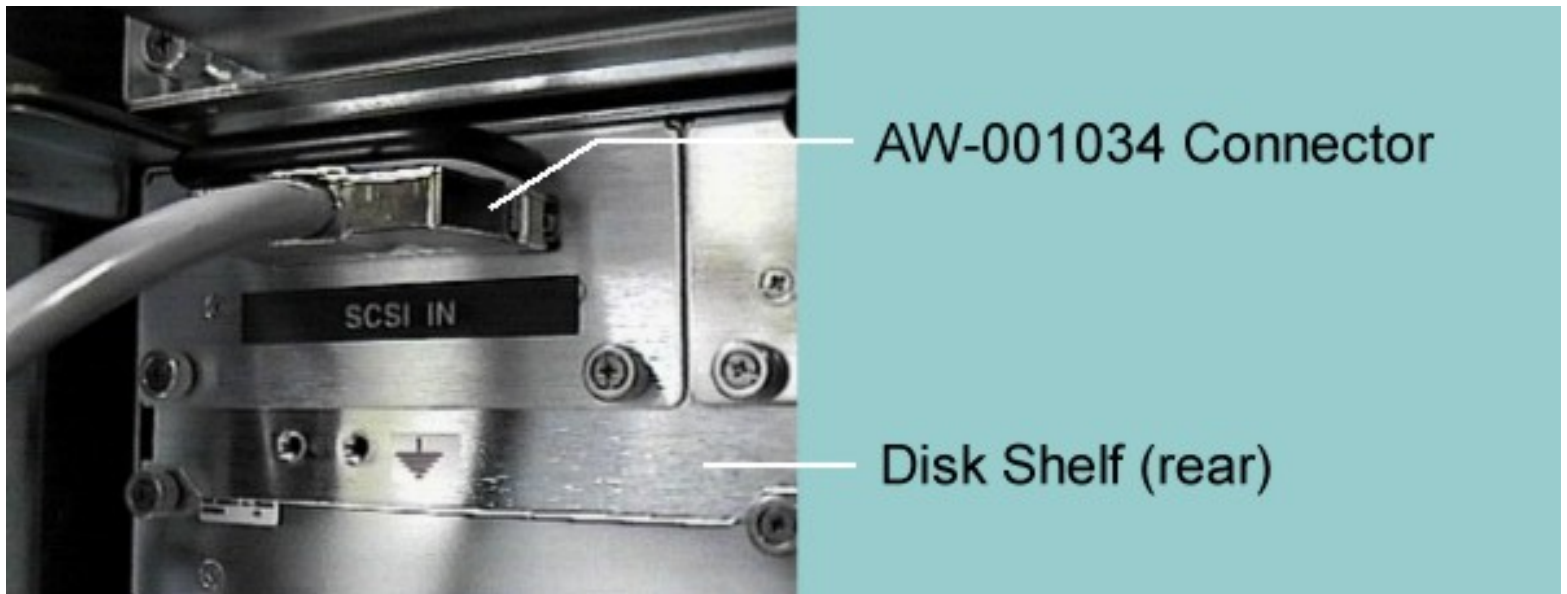
Figure 4-47. Removing the Screws from the PCI/Suitcase Chassis



4. Open the cabinet rear door.

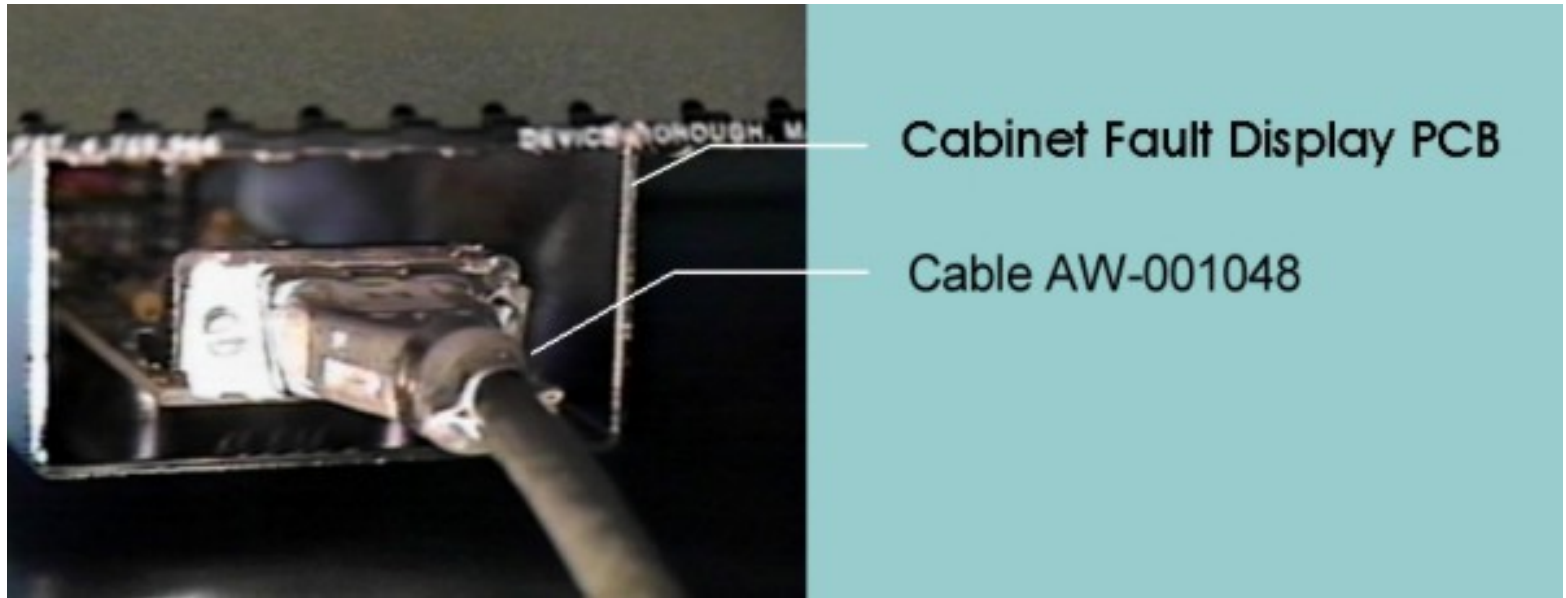
5. Disconnect the AW-001034 cables from the disk shelf (rear). (See Figure 4-48.) [This step is necessary so that the AW-001034 cables are not strained while moving the PCI/suitcase chassis.]

Figure 4-48. Disconnecting the Disk Shelf SCSI Data Cable Connectors from the Disk Shelf (rear)



6. At the very top of the cabinet, disconnect the CPU backplane power cable (AW-001048) from the cabinet fault display PCB. (See Figure 4-49.)

Figure 4-49. Disconnecting The CPU Backplane Power Cable from the Cabinet Fault Display PCB



7. (See Figure 4-50.) On the AC power chassis, disconnect:

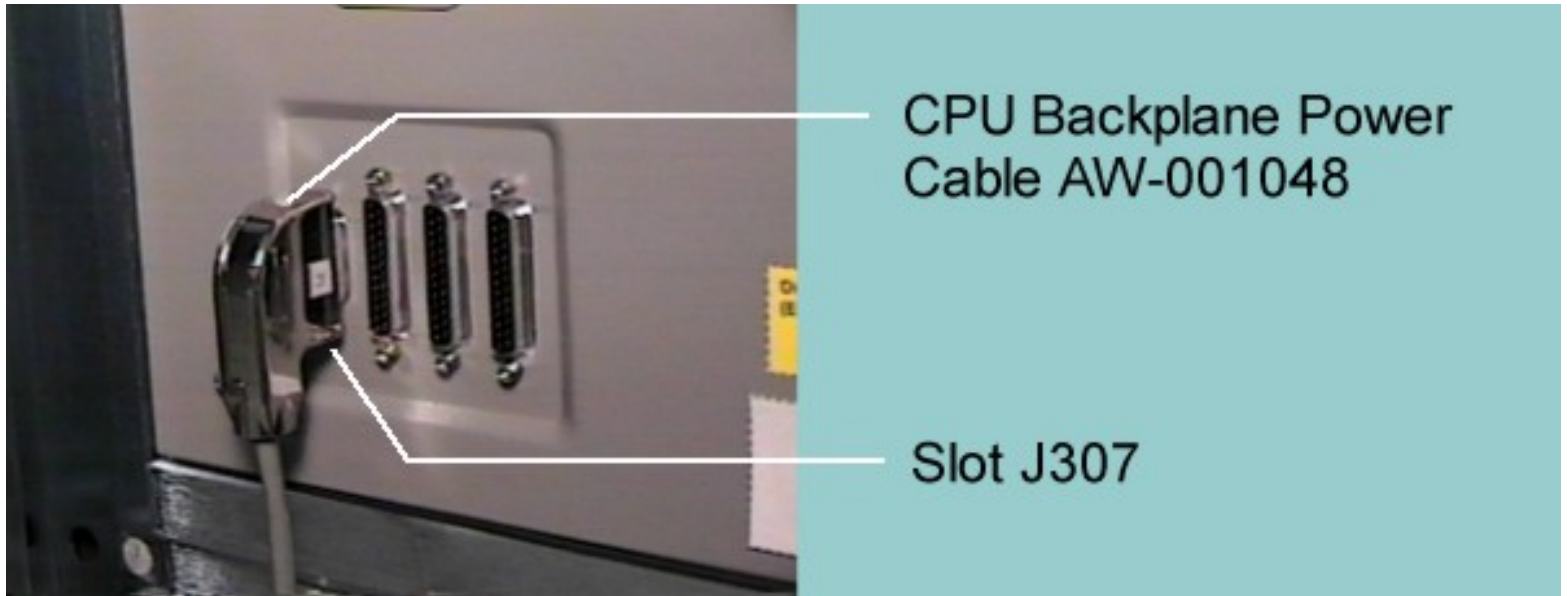
- The AW-001048 CPU backplane power cable from J007
- Two AW-001047 PCI backplane power cables from J008 and J009 (This will kept avoid strain on this cable when moving the PCI/suitcase chassis)

Figure 4-50. Disconnecting the CPU and PCI Backplane Power Cables from the AC Power Chassis



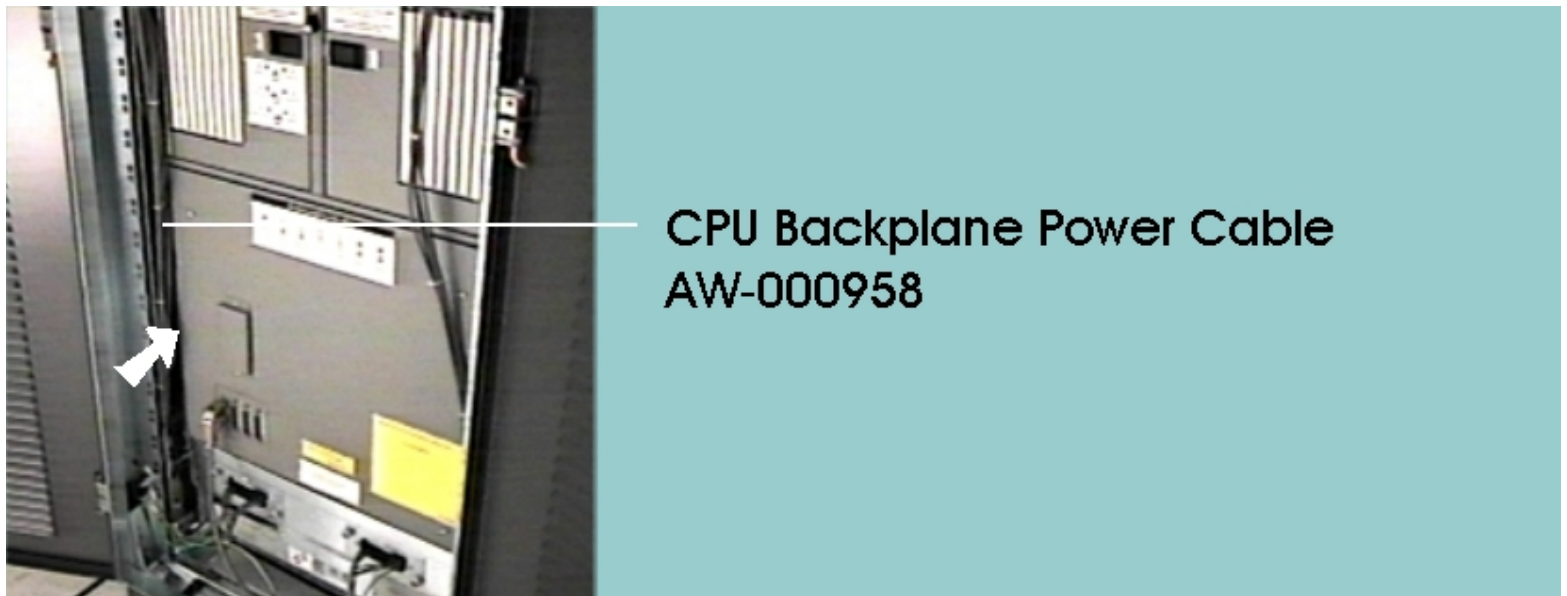
8. At the bottom of the cabinet, disconnect the CPU backplane power cable (AW-001048) from the CPU backplane. (See Figure 4-51.)

Figure 4-51. Disconnecting the CPU Backplane Power Cable from the CPU Backplane



9. Carefully push the PCI/suitcase chassis a few inches forward until there is enough space to access and remove the CPU backplane power cable. (See Figure 4-52.)

Figure 4-52. Accessing the CPU Backplane Power Cable



Replacement Note: When installing the replacement CPU backplane power cable, carefully route the cable along the cabinet frame so that when the PCI/suitcase chassis is pushed back into place it will not pinch the cable.

4.5.13 PCI Backplane Power Cable (AW-001047)

1. Shut down the system from the system console.
2. Open the cabinet front door and turn off both main power switches. (See Figure 4-1.)
3. Open the cabinet rear door.
4. Using a small flat blade screwdriver, disconnect the end of the PCI backplane power cable (AW-001047) from connector J008 or J009 (depending on which cable is faulty) on the Tray 2, rear. (See Figure 4-53.)

Figure 4-53. Disconnecting the PCI Backplane Power Cable from Tray 2 (rear) (J009 plug is shown here)



5. Open the cabinet front door.
6. Open the access door to the PCI backplane. (See Figure 4-3.)
7. Disconnect the other end of the AW-001047 cable from the PCI backplane. (See Figure 4-54.)

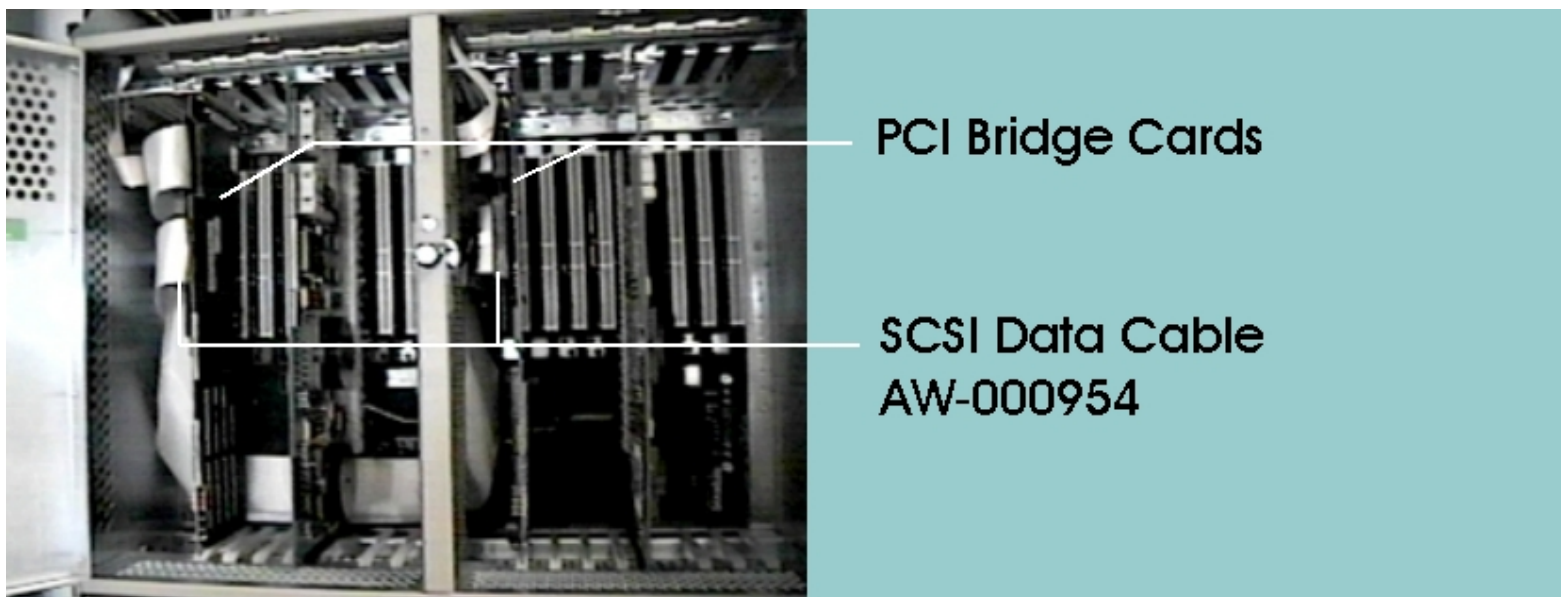
Figure 4-54. Disconnecting the PCI Backplane Power Cable from the PCI Backplane



4.5.14 SCSI Data Cable - PCI Bridge Card/PCI Backplane (AW-000954)

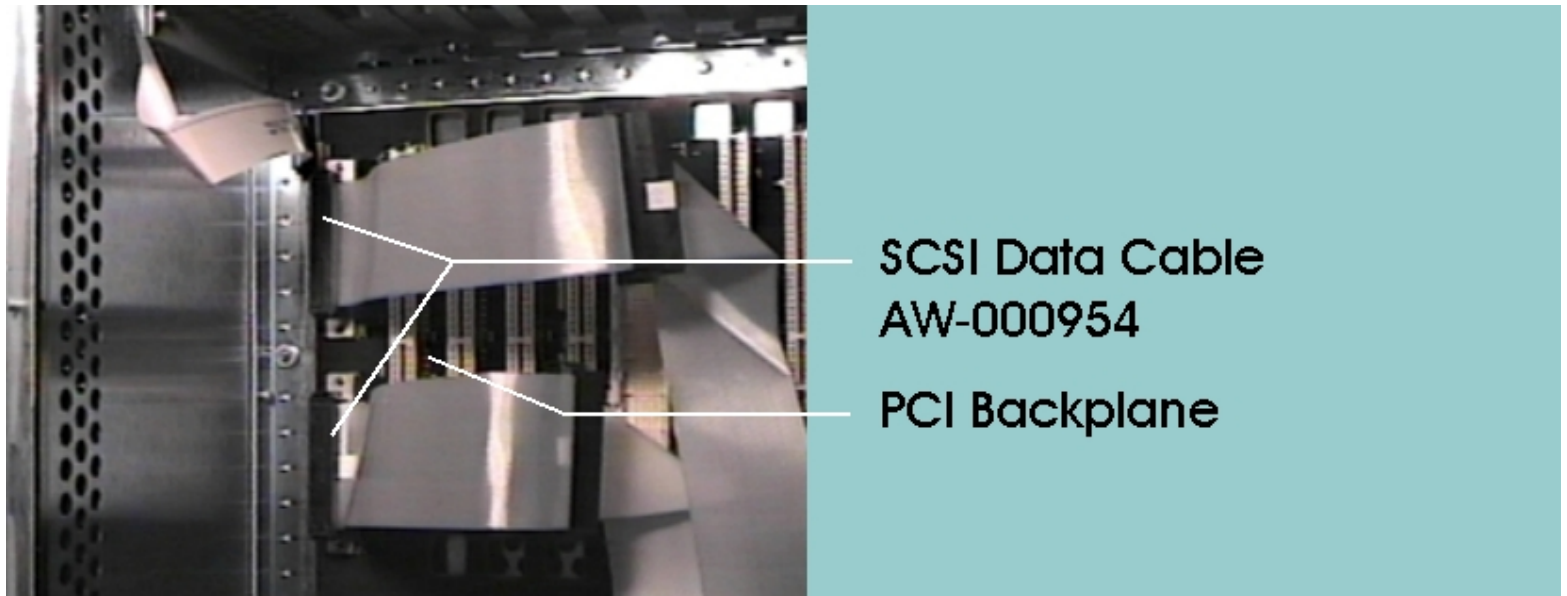
1. Open the cabinet front door and turn off the switches on both PCI power supplies.
2. Open the cabinet rear door.
3. Open the PCI card cage access door. (See Figure 4-2.)
4. Disconnect the SCSI data cable from the PCI bridge card. (See Figure 4-55.)

Figure 4-55. Disconnecting the SCSI Data Cable from the PCI Bridge Card



5. Remove the PCI bridge card (CRU) to access the PCI backplane.
6. Disconnect the other end of the cable from the PCI backplane. (See Figure 4-56.)

Figure 4-56. Disconnecting the SCSI Data Cable from the PCI Backplane



7. Repeat steps 3 through 6 for the second PCI bridge card)

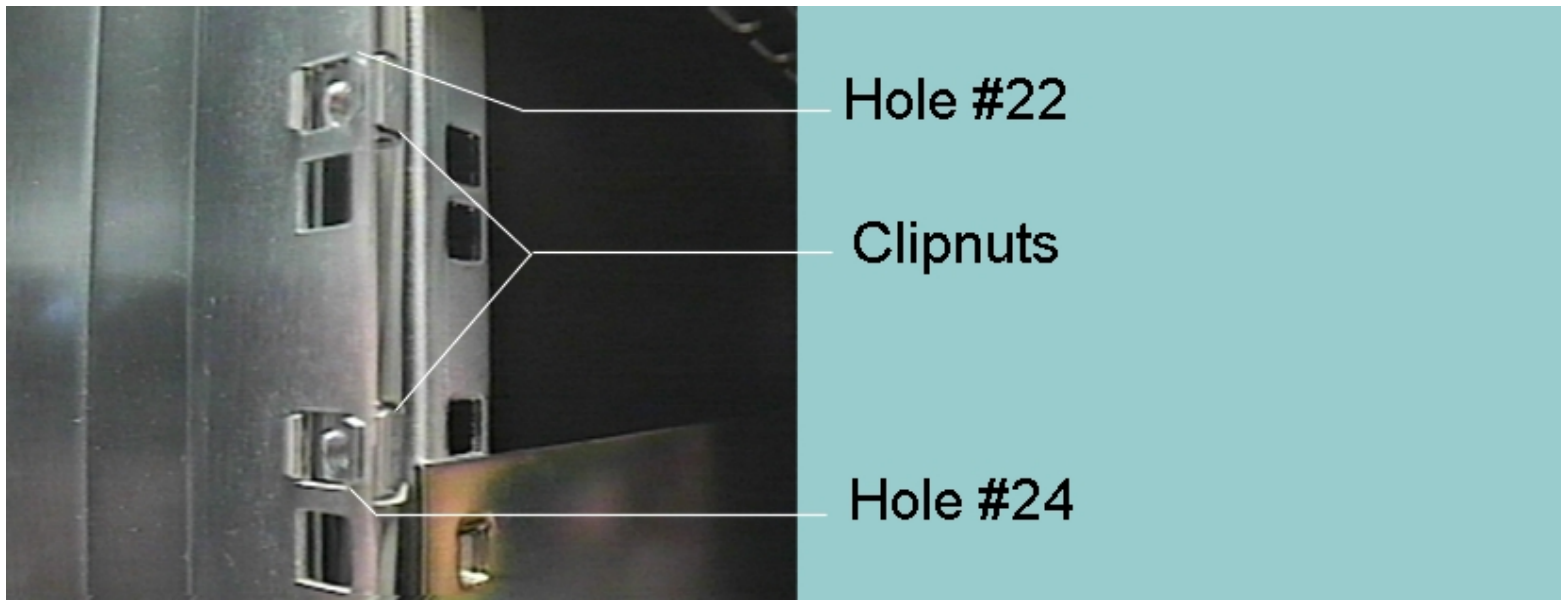
4.5.15 Installing U450 16-port Support Bracket (AK-000331)

1. Open the cabinet rear door.

CAUTION: Place some sheets of paper (or other material) over the PCI card cage to prevent any hardware from falling in.

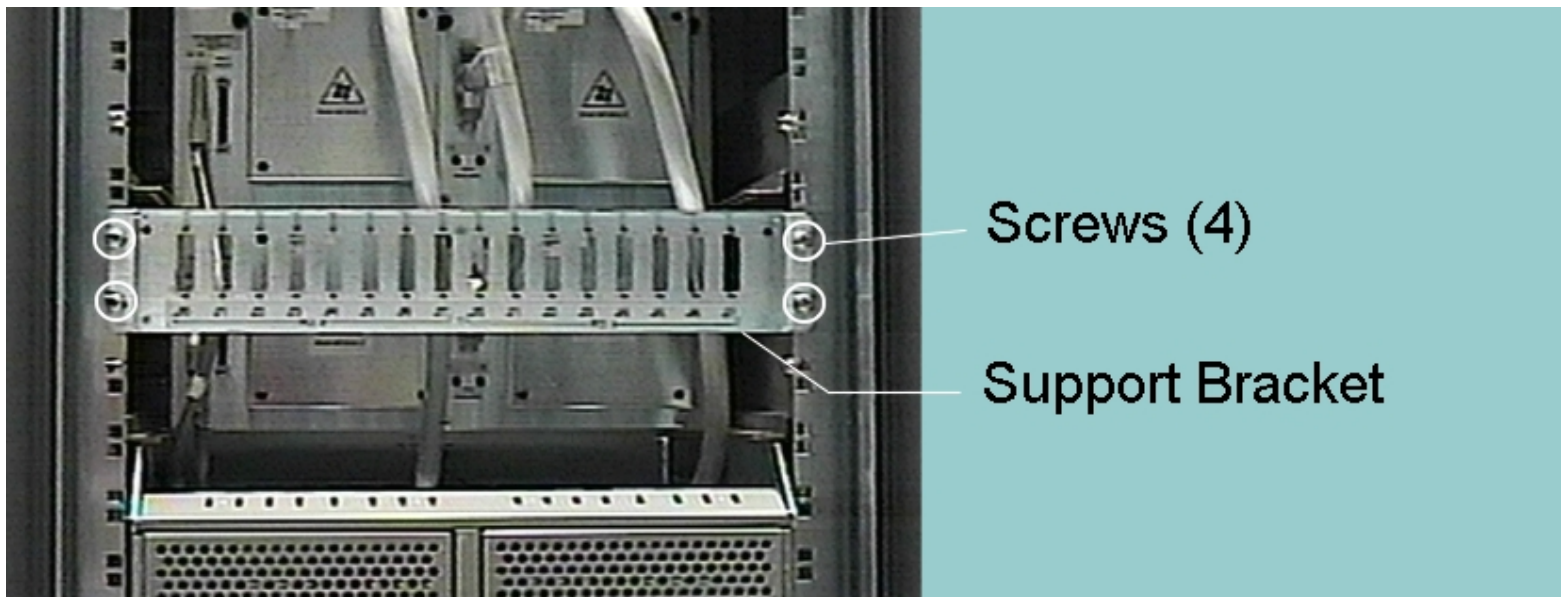
2. Install clip nuts in holes #22 and #24 (counting down from the top) on the vertical rails on each side of the chassis. (See Figure 4-57.)

Figure 4-57. Installing Clip Nuts



3. Mount the support bracket and secure it with four screws as shown in Figure 4-58.

Figure 4-58. Mounting the 16-port Support Bracket.

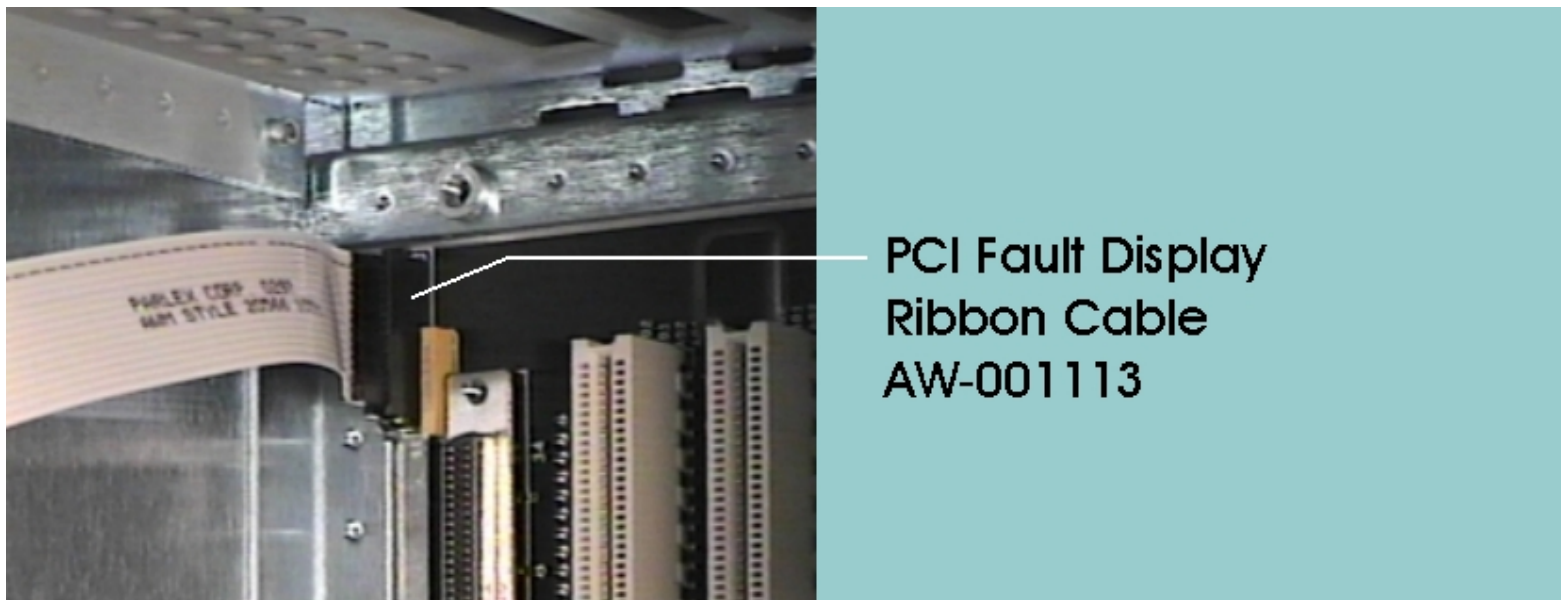


4.5.16 Cable - PCI Backplane/PCI Fault Display PCB (AW-001113)

1. Open the cabinet front door and turn off the switch on the PCI power supply that provides power to the side of the cabinet containing the failed cable.
2. Open the cabinet rear door.

3. Open the PCI card cage access door on the side containing the failed AW-001113 ribbon cable. (See Figure 4-2.)
4. Remove the PCI bridge card (CRU).
5. Disconnect the PCI fault display ribbon cable from the PCI backplane. (See Figure 4-59.)

Figure 4-59. Disconnecting the Ribbon Cable from the PCI Backplane



6. Disconnect the other end of the cable from the PCI fault display PCB. (See Figure 4-60.)

Figure 4-60. Disconnecting the Ribbon Cable from the PCI Fault Display PCB



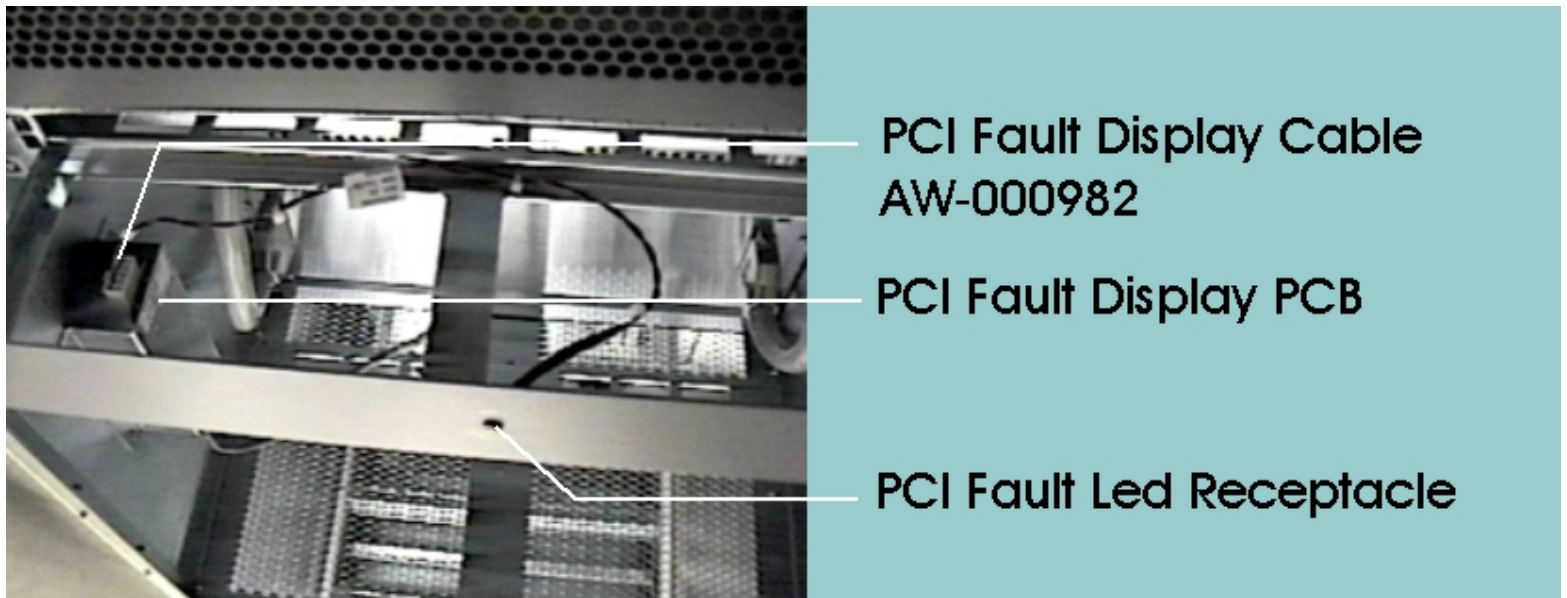
4.5.17 PCI Fault Display Cable (AW-000982)

1. Open the cabinet front door.
2. Open the access door to the PCI backplane. (See Figure 4-3.)

Refer to Figure 4-61 when performing the following steps.

3. Disconnect the PCI fault display cable from the cabinet fault display PCB.
4. Pull the LED end of the cable out of the PCI fault LED receptacle.

Figure 4-61. Removing the PCI Fault Display Cable



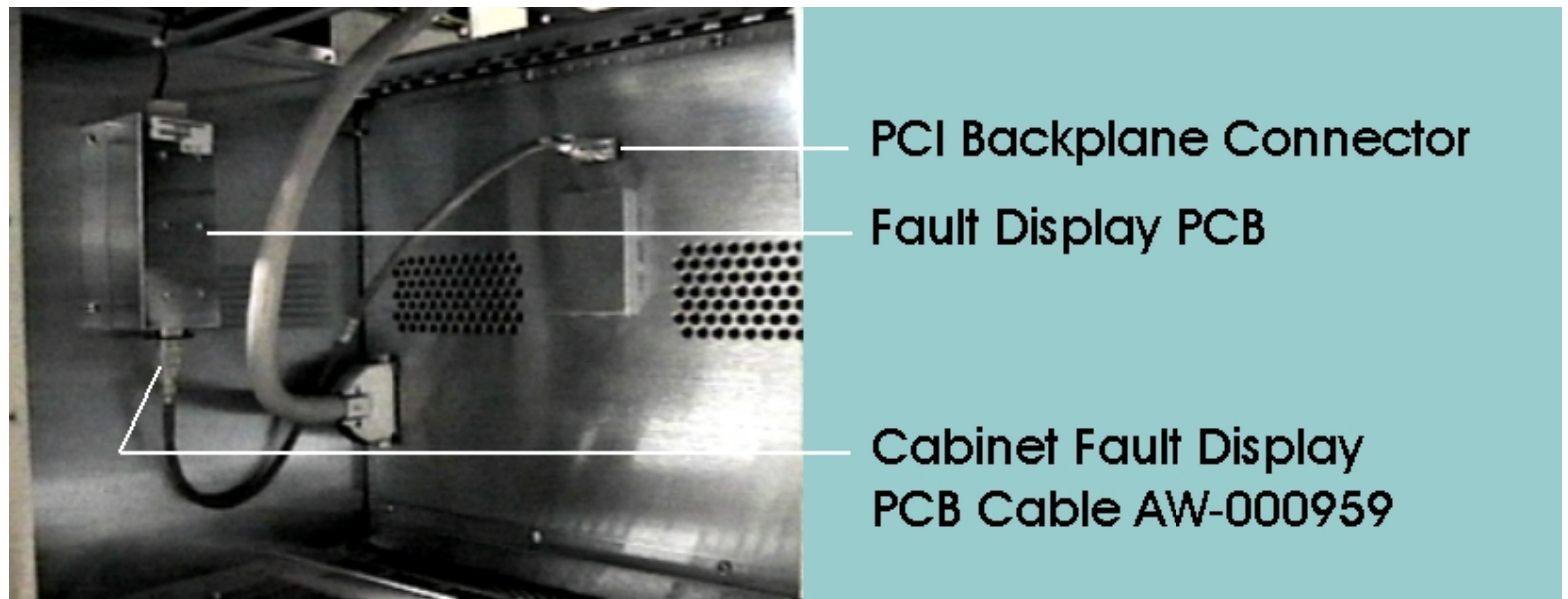
4.5.18 Cabinet Fault Display PCB Cable (AW-000959)

1. Open the cabinet front door.
2. Open the access door to the PCI backplane. (See Figure 4-3.)

Refer to Figure 4-62 when performing the following steps.

3. Disconnect the cabinet fault display PCB cable from the PCI backplane.
4. Disconnect the other end of the cable from the cabinet fault display PCB.

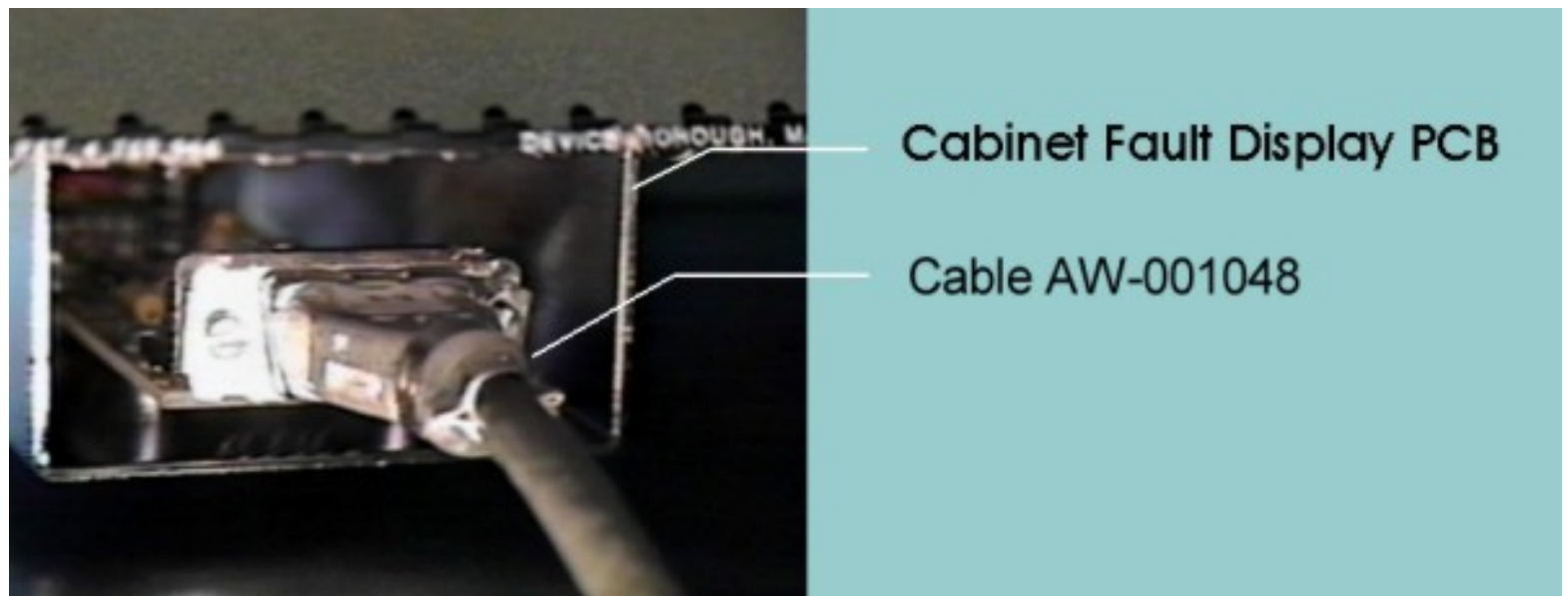
Figure 4-62. Disconnecting the Cabinet Fault Display PCB Cable



4.5.19 Cable - Cabinet Fault Display PCB/Cabinet Fault LEDs (AW-000985)

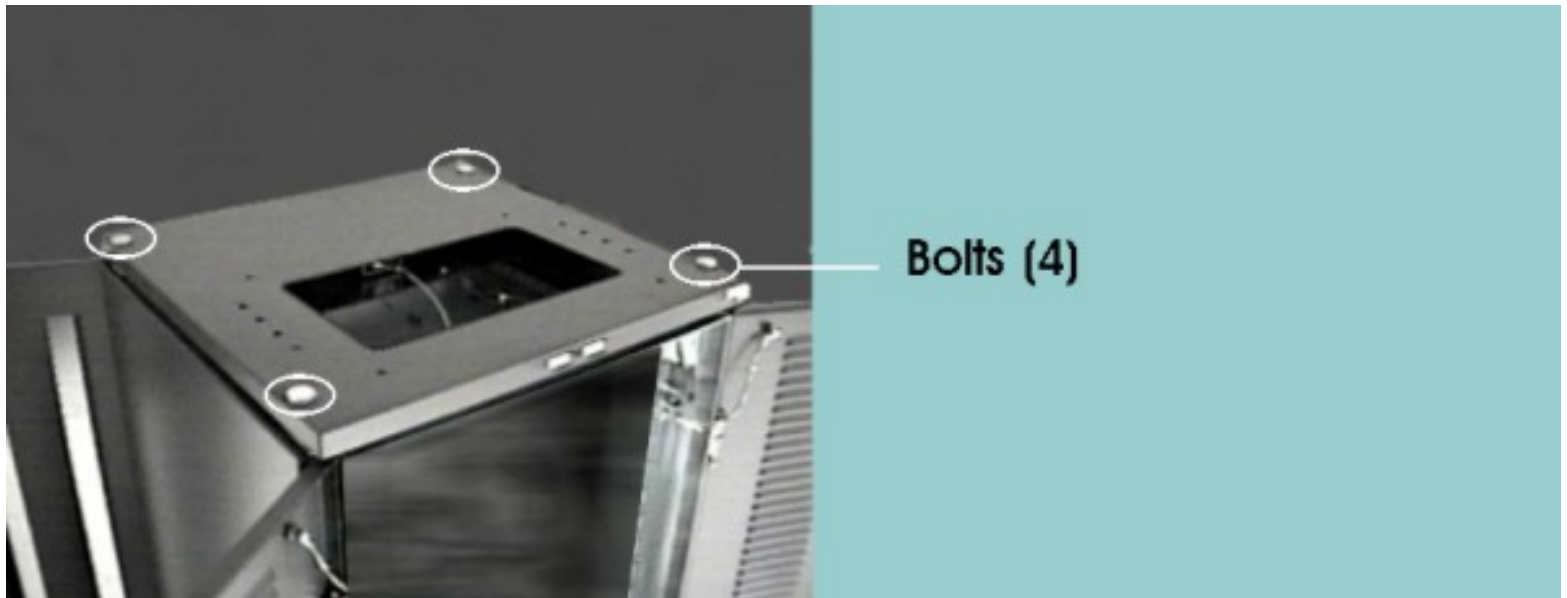
1. Open the cabinet rear door.
2. At the top of the cabinet, disconnect the AW-001048 cable from the cabinet fault display PCB. (See Figure 4-63.)

Figure 4-63. Disconnecting the AW-001048 Cable from the Cabinet Fault Display PCB



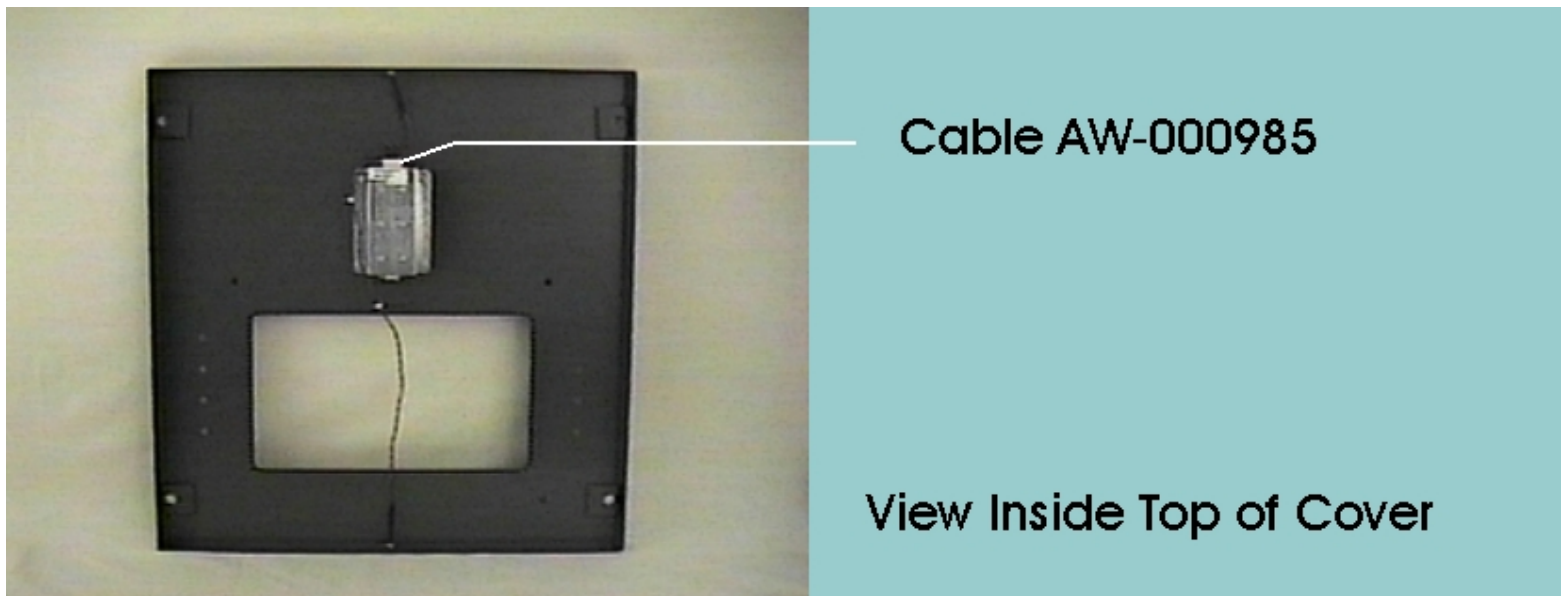
3. Using pliers or a 15/16" open end wrench, remove the four bolts securing the cabinet top cover. Remove the cover. (See Figure 4-64.)

Figure 4-64. Removing the Bolts from the Cabinet Top Cover



4. Disconnect the AW-000985 cable from the cabinet fault display PCB and the front and rear LED receptacles. (See Figure 4-65.)

Figure 4-65. Disconnecting the AW-000985 Cable from the Cabinet Fault Display PCB



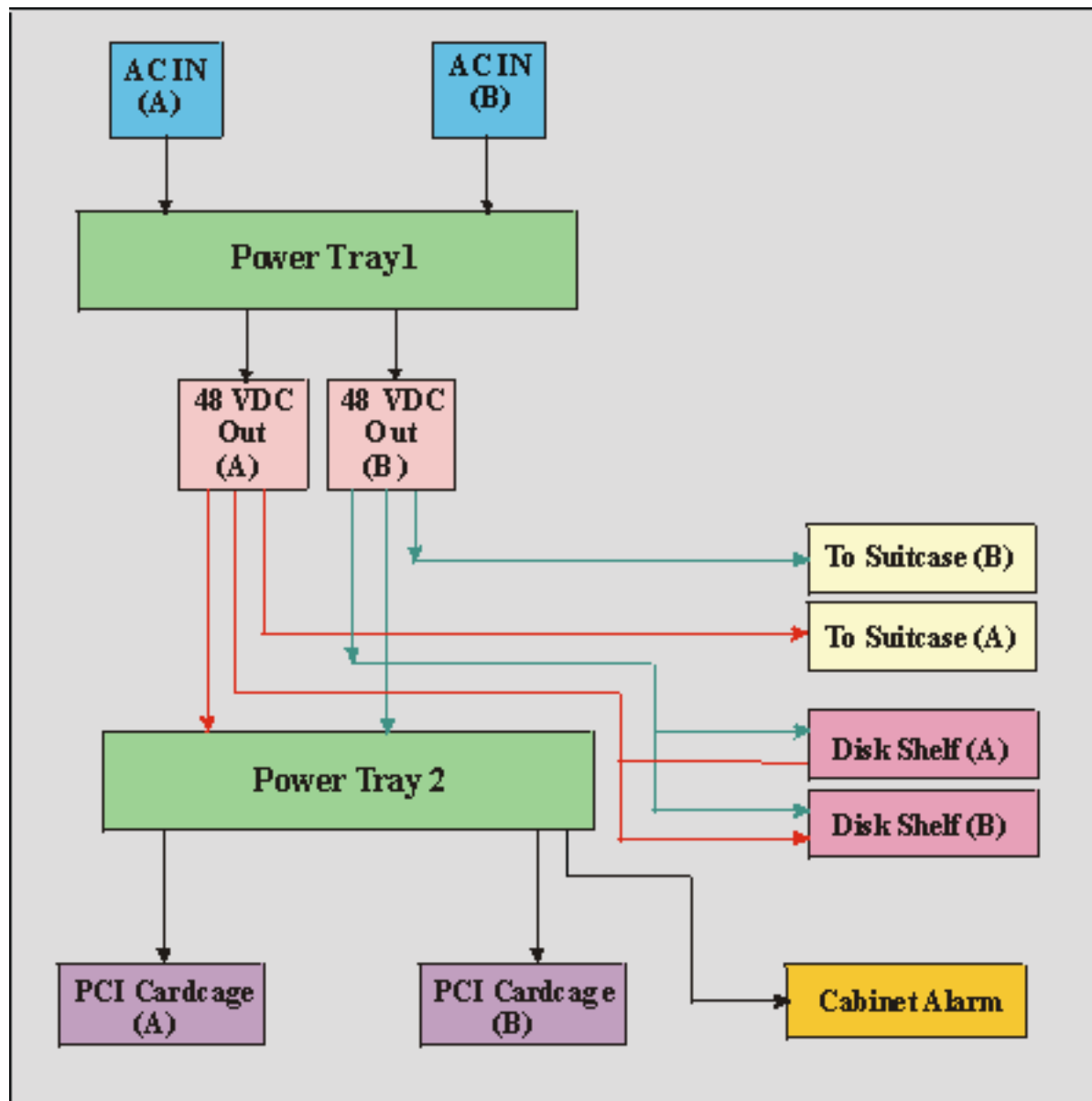
5. Theory of Operation

This section contains an overview of the theory of operation for the PA-8500 Continuum 400 Series systems. It provides information on how the system operates and includes a description of each of the following major assemblies/subsystems.

- Suitcase
- PCI Subsystem
- Disk Subsystem
- Power and Control Subsystem
- Cooling Subsystem

A high-level architectural view of the PA-8500 Continuum 400 Series system is shown in Figure 5-1.

Figure 5-1. PA-8500 Continuum 400 Series System Block Diagram



5.1 Suitcase

One of the major assemblies in the PA-8500 Continuum 400 Series system is the suitcase. There are two identical suitcases. The operating status and fault conditions of the suitcase are displayed on LEDs located on the front bezel of each suitcase.

The suitcase houses the following components/subassemblies:

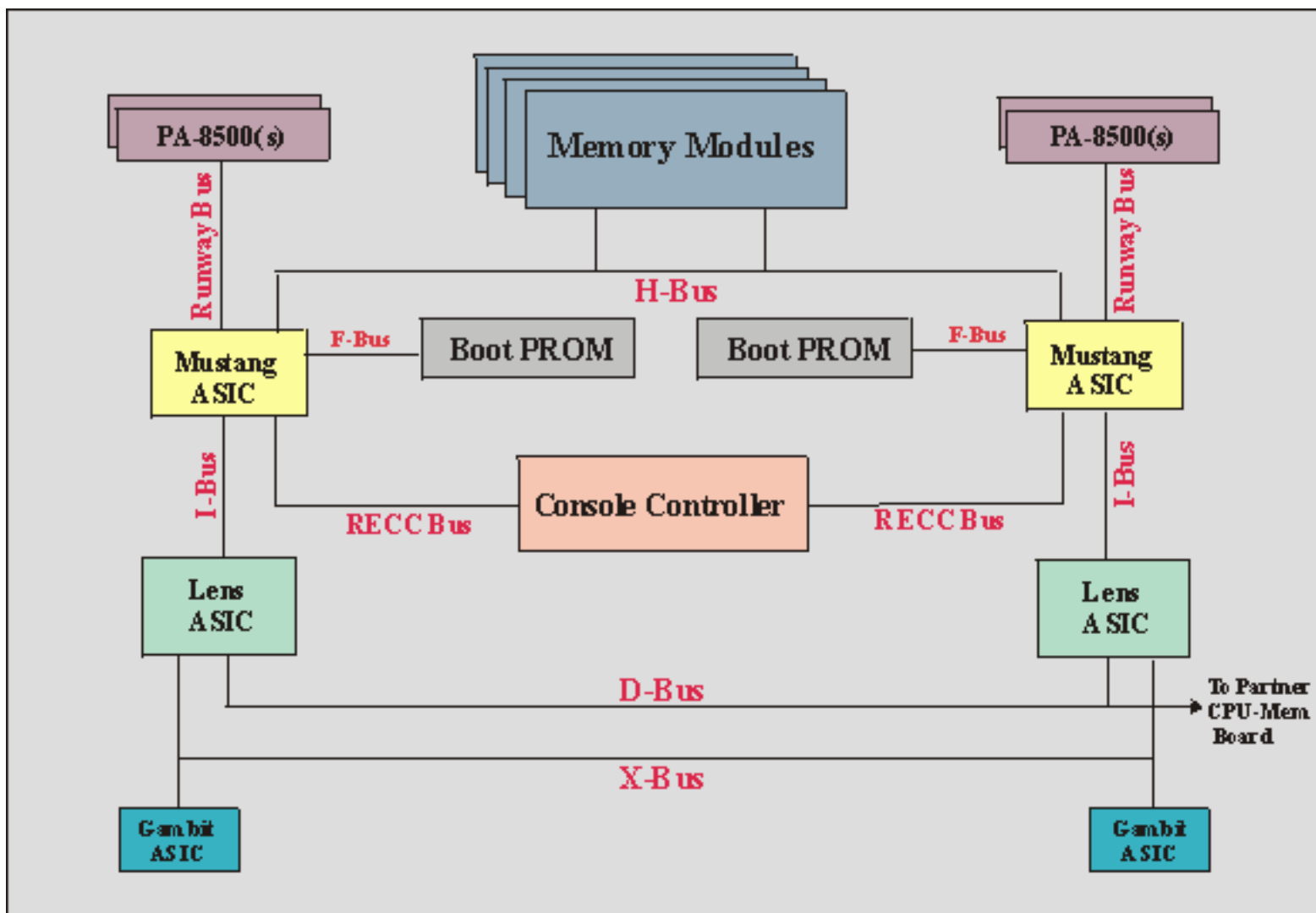
- CPU-Memory board
- Cooling fans
- Power supply

5.1.1 CPU-Memory Board

The CPU-Memory board is actually a motherboard that provides the interface between the PA-8500 processors and the system. It replicates most logic into Drive and Check (C and D) sides. The board contains two PA-8500 daughter boards (which can be either Uni or Twin), up to four memory modules, and the Console Controller.

Figure 5-2 is a block diagram of the CPU-Memory board and its interfaces.

Figure 5-2. CPU-Memory Board Block Diagram



The two PA-8500 processors on either side communicate with each other and the Mustang ASIC (interfaces the processors with I/O and memory) over a 120-Mhz bus (Runway bus). There are two Runway busses (C-side and D-side). Because of timing and pin constraints these busses are not crosschecked, but any subsequent transactions to the memory, I/O, or Console Controller are checked. The Runway bus is a 64-bit wide bi-directional multiplexed address/data bus supporting split response transactions and out-of-order transaction completion, thus optimizing system performance and enhancing processing of multiple operations simultaneously. All cache coherency operations are performed on the bus and made visible to all entities on the bus, thus external snoop tags are not required.

The two Mustang ASICs (C and D) transfer memory requests to the 60-MHz H-Bus running between the Mustang ASICs and the memory modules. The H-Bus has a 128-bit + parity wide data bus that is shared between the C and D sides. There are separate C and D side address/control lines. For data operations, the C-side device drives 64 bits of data and the D-side device drives the other 64 bits. Each Mustang ASIC receives the full 128-bit data and can thus check the data driven on writes. On reads, the data is cross checked by custom ASICs on the memory cards. It is also parity protected.

During system boot up time, the CPUs fetch their instructions for initialization from a boot prom prior to execution from main memory. This boot prom is a single AMD 29F040 (512Kx8bit) flash PROM. This PROM is duplicated from C to D side and is accessed over the dedicated F-Bus (the flash bus between the Mustang ASICs and the CPU's flash PROM). The main bus is 16 bits wide for addressing the PROM

and eight of those bits are multiplexed with the data read from the PROM. An 18504 latch part is used to hold the address at the inputs to the PROM to allow the pins to be multiplexed.

The backplane (X-Bus) interface on the CPU-Memory board is provided by a pair of Lens ASICs that interface the CPU subsystem with the I/O subsystem. The Lens ASIC connects the X-Bus with the CPU-Memory board's internal I-Bus. In addition to serving as a bus interface, the Lens ASIC provides fault detection and isolation for the motherboard. The two major interfaces, the X-Bus (24 MHz) and the I-Bus (48 MHz), together make up a large portion of the functionality of this ASIC. Each Mustang ASIC communicates with its respective Lens ASIC over the I-Bus.

The Lens ASIC also has a dedicated bus for memory updates during duplexing called the D-Bus. This D-Bus is a byte wide bus between the two CPU-Memory boards in the system running at 96MHz. The use of this bus greatly speeds up the copying of main memory contents from the online board to the offline board during full duplex operations. It also decreases the load on the X-Bus during duplexing and thus system performance degradation during duplexing is much reduced.

Two Complex Programmable Logic Devices (CLPD) are included on the board to guarantee that the system reset and clocks meet HP specifications. They also perform some miscellaneous logic functions, thus eliminating discrete SSI/MSI components from the board.

The CPU-Memory board also contains the logic required to implement the Console Controller interface, including two 68K processors and associated logic. The board takes advantage of the integration of logic into the Console Controller (RECC) ASICs to provide the checking and multiplexing function. The CPU interface to the 4-MHz RECC bus is provided from the Mustang ASIC through the Console Controller ASICs and the backplane transceivers.

5.1.1.1 PA-8500 Processor

The 64-bit PA-8500 processors are located on daughter boards that plug into the motherboard. They are available in uni or twin processor designs running at 360 MHz with 1.5 MB of L1 on-chip 4-way associative cache, which minimizes system latency and boosts performance. The on-chip memory cache consists of 0.5 MB Instruction cache (I-cache) and 1.0 MB Data Cache (D-cache). The PA-8500 processor contains 140 million transistors and uses the .25-micron manufacturing process.

The PA-8500 processor uses a 360-MHz clock and a 120-MHz clock. The 360-MHz clock is provided by a low voltage PLL clock driver.

5.1.1.2 Memory Module

A memory module contains 0.5 GB or 2 GB of memory. The CPU-Memory board can contain from one to four memory modules. Maximum duplexed memory is 4 GB. For the most current information on available memory refer to the [Continuum Memory Subsystem Technical Reference](#). The document is also available in [PDF format](#)

5.1.1.3 Console Controller Module

The PA-8500 Continuum 400 Series system does not contain a physical control panel. Operating commands are entered at the system console that is connected to the system via the Console Controller

module on the CPU-Memory board.

Each Console Controller module operates independently of the rest of the CPU-Memory board on which it is located. It functions as a centralized controller for the entire system performing the following critical functions:

- Serves as a central collection point for Maintenance and Diagnostics (M&D) services.
- Controls and monitors the main power supply for the system.
- Provides a console command (front panel) interface.
- Contains the hardware calendar/clock and NVRAM used to store data across boot loads.
- Contains an ID PROM which stores information such as modelx, serial number, etc.
- Supports four async ports (located on the rear of the CPU backplane)

In addition to the above, the Console Controller includes burnable PROM partitions that contain code for the following: board-level diagnostics, online and standby board operations. The diagnostics and board operations code (both online and standby) are burned onto the board at the factory. To update this code, a new firmware file can be burned into these partitions.

The Console Controller also contains a burnable PROM data partition that stores console port configuration information (bits per character, baud rate, stop bits, and parity) and certain system response settings. The defaults can be reset by entering the appropriate information and reburning the partition. It also contains a burnable PROM data partition that stores information on where the system should look for a bootable device when it attempts to boot automatically.

The Console Controllers are logically paired (not fully duplexed) so that one board is online while the other is on standby status. The online Console Controller is active on the Console Controller bus and communicates with other components in the system. The standby Console Controller is active on the Console Controller (RECC) bus, but cannot communicate with the rest of the system; it is electrically isolated from all external devices except the RECC bus. In the event of a hardware failure of the online Console Controller, the hardware automatically performs a "failover" operation to the standby Console Controller. All ports on the new online Console Controller are initialized and I/O operations can resume. Failover can be manually initiated by breaking or deleting the online Console Controller.

5.1.2 Cooling Fans

The suitcase is cooled via forced convection (air). The suitcase is equipped with two tube-axial fans, which are located at the top of the suitcase enclosure. These fans are speed controlled so as to both minimize acoustic noise, and enhance fan reliability when operating in room ambient temperatures less than 30 ° C, during which time the fans will run at a reduced nominal speed. The fans evacuate air from the suitcase, and in so doing, provide for free stream air velocities within the suitcase enclosure that are sufficient to cool the majority of components within.

The suitcase fans are each capable of providing an open flow (Zero Static P) rate of 220 CFM. The fans are also capable of overcoming a maximum static pressure of .65 inches of water.

Air (at room ambient temperature) enters the suitcase through the inlet side of the suitcase. Air passes through and across the various PCBs and packaged electronics in a uniform manner with an even

velocity profile. Air then passes through the exhaust fans and is discharged out the top of the enclosure. Heat dissipation for the suitcase is 800 Watts. System flow rate is 150-250 CFM, resulting in an overall bulk temperature rise across the suitcase of approximately 9 ° C (worst case).

Temperature information is acquired by thermal sensors in the suitcase and is used to drive the fan speed. The fans operate in normal mode (half speed) when the system is operating in a room ambient temperature of less than 30° C (86° F). The fans in both suitcases go to full speed if any of the following events occur:

- Ambient room temperature exceeds 30° C (86° F)
- A suitcase is broken or not present

A suitcase fan failure results in a fault condition bringing down that particular suitcase.

5.1.3 Power Supply

The suitcase power supplies are independent of each other, with each one supplying power only to the suitcase in which it is housed. Each power supply has an interface PCB that provides an intelligent interface between the CPU-Memory board and the power supply.

The suitcase power supply provides 5 VDC, 3.3 VDC, VRM5V, 24 VDC and -5 VDC to the various loads within the suitcase. The interface PCB monitors the status of the power supply outputs and provides 12 VDC (made from 24 VDC) to power the processor PCB fans.

The suitcase power supply provides four outputs that are electrically isolated from the DC line input and from the chassis. Outputs #1, #2, and #4 are not electrically isolated from one another, but output #3 (+24 VDC) is electrically isolated from the other three. The maximum steady state power drawn from the power supply is 410 watts.

The following table shows the output voltages and the associated maximum currents for the suitcase power supply.

Output #	Voltage	Current	Power	Application
1	+5 VDC	64 A	320 W	Logic bias
2	+3.3 VDC	3.0 A	9.9 W	Logic and memory
3	+24 VDC	3.0 A	72 W	Fan bias
4	-5 VDC	1.5 A	7.5 W	Logic bias
Total			409.4 W	

A failure in a suitcase power supply results in a suitcase failure, but not a system interruption.

5.2 PCI Subsystem

The major components in the PCI subsystem are the PCI bus, two PCI bridge (PCIB) cards, and up to 14

PCI adapter cards. The PCIBs act as the interface between the system bus (XBus) and the PCI buses. They isolate the PCI cards from the suitcase, so that a suitcase failure does not adversely affect PCI card availability.

5.2.1 PCI Bus

The PCI bus is an industry standard bus developed by Intel. It is a fully synchronous 32-bit bus running at 24 MHz. It uses a multiplexed address/data bus to transmit information. The bus is a high bandwidth, low latency local bus that only supports 5.0 V cards. It supports PCI adapter cards that are 12.8" x 4.2" or 6.4" x 4.2" in size.

The PCI subsystem contains four logical PCI buses. Each bus has four PCI slots. The PCI bridge (PCIB) card and its onboard PCMCIA flash card are located between slot #3 and slot #4. The I/O backplane provides signal, power and ground interconnection between the two logic suitcases and the two I/O sections of the system.

Each PCI card is accessible directly from either suitcase via the PCI bus. Logic in the suitcase provides fault tolerance over the PCI bus and protects against failures of the cards. For full fault tolerance, it is recommended that all PCI card communications connections be duplicated, one for each of the PCI subsystems.

The PCI buses are powered separately so that at least one of the disk PCI cards will always have power. When a PCI enclosure access door is opened, its PCI bus is automatically powered down. (There is an interlock that allows only one half of the bus to have its door open at a time.) When the access door is closed, the card cage comes back online and a full PCI configuration sequence is initiated.

Online fault detection and isolation includes identifying failing PCI adapters, identifying properly functioning PCI adapters when a failure is indicated, and, when possible, determining cable failures or disconnected cables. Online fault detection tools consist of internal/external loopback tests and off-the-shelf network tools.

Each PCI card is in one of three possible states: broken, offline, or online simplex. The state is shown by a row of LEDs on the card cage above each card.

A broken board is basically isolated from the system. It will respond to writes, but will not respond to reads. A broken board usually indicates a hardware failure that requires either a reset or repair.

An offline board is a good board that did not transition to the online state. It will respond to all writes and will respond to board I/O reads. However, in the offline state, a board will not respond to memory reads. Typically, the offline state is a transitional state, used by the board that is still initializing or running diagnostics.

An online simplex board is a fully functional running board, but not running in lockstep with a partner board. In this state, a board will respond to all operations of any kind, including read access.

5.2.2 PCI Bridge Card

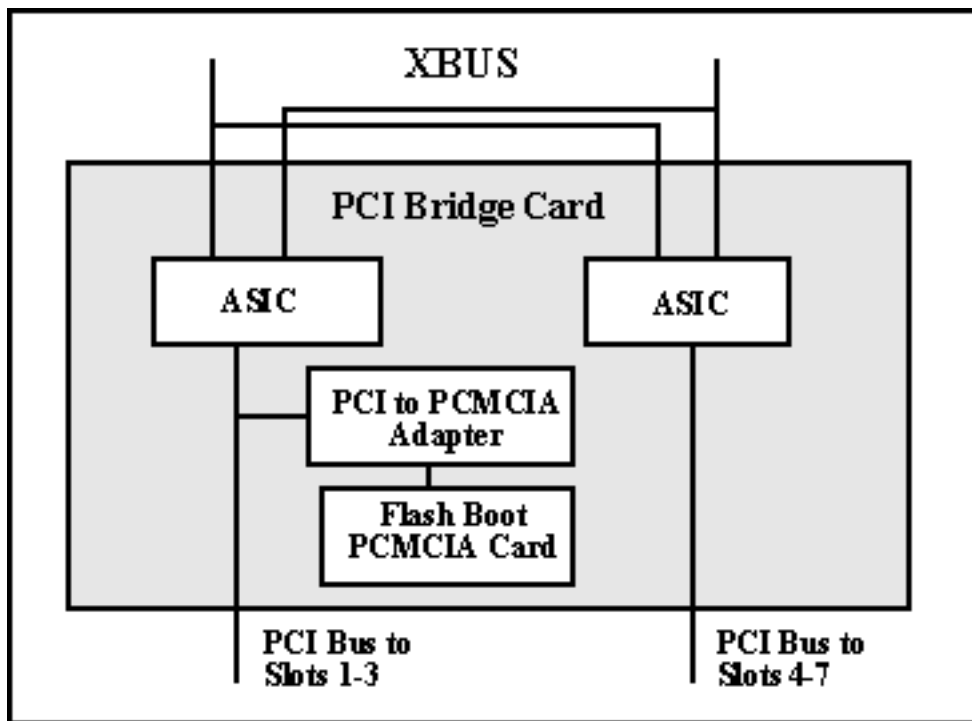
The PCI bridge (PCIB) card is the interface and control unit for the PCI cards. The system consists of two PCIBs, each of which acts as the interface between the CPU and one logical PCI bus. The system

bus (XBus) provides the interconnection between the CPU-Memory boards and the PCIB. The PCIBs contain two ASICs that each talk to a PCI bus and a FLASH PROM for OS boot. A 20-MB removable PCMCIA flash card resides on each PCIB card.

The PCIB boards do not run in lockstep mode and cannot be duplexed. Their normal operational state is online simplex. However, if all disk drives are duplicated on different controllers and comm is duplicated via software in both PCI card cages as needed, opening a PCI card cage access door on a running system should cause no problems.

Figure 5-3 shows a block diagram of the PCIB card.

Figure 5-3. Block Diagram of PCIB Card



5.2.2.1 Flash card

A 20-MB removable PCMCIA flash card resides on each PCIB card. These are credit-card-sized EEPROMs whose function is to perform the primary boot functions. The system can be booted from either flash card as long as it has a current version of the bootloader program. The CPU PROM makes the flash card look like a read-only disk during the boot process.

The flash card contains the primary bootloader, a configuration file, and the secondary bootloader. The HP-UX operating system is stored on the root disk and booted from there.

A flash card contains three sections. The first is the label, the second is the primary bootloader, and the third is the Logical Interchange Format (LIF).

Label	Primary Bootloader (lynx)	Logical Interchange Format (LIF) - CONF (configuration file) - BOOT (secondary bootloader)
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The following table describes the LIF files.

File Name	Description
CONF	The bootloader configuration file. This file is equivalent to the /stand/conf file on the root disk.
BOOT	The secondary bootloader image, which is used to boot the kernel.

At system startup, the operating system boots from the flash card and assumes that it contains the correct version of the bootloader configuration file in **CONF**. If there is no **CONF** file, the system cannot boot. At system startup, HP-UX boots from the flash card and assumes it contains the correct version of the HP-UX kernel. HP-UX compares the contents of the **HP_UX** file on the flash card (from which the system booted) to the contents of the **/stand/vmunix** file on the root disk. If they are not identical, HP-UX automatically updates the **/stand/vmunix** on the root disk to match the **HP_UX** file on the flash card.

At system startup, the operating system boots from the flash card and assumes that it contains the correct version of the bootloader configuration file in **CONF**. If there is no **CONF** file, the system cannot boot.

The operating system provides default values for key parameters in the bootloader configuration file. If it is appropriate, permanent changes can be made to the system configuration by editing the **/stand/conf** file on the root disk with a text editor and copying the file to the booting flash card.

5.2.3 PCI Adapter Cards

The PCI adapter cards are designed for +5 VDC and a 32-bit bus. The system supports a maximum of 14 PCI cards. Each PCI slot in the card cage contains three LEDs that indicate the state of the board.

The following PCI cards are supported in PA-8500 Continuum 400 Series systems.

5.2.3.1 U403-01/02/03/04 Synchronous Adapter

The PA-8500 Continuum 400 Series employs the U403 PCI adapter to provide four-port synchronous serial interfaces. The four-port U403s are full-sized PCI adapter cards consisting of three items:

1. IBM ARTIC 960 Co-Processor platform (with 4 MB of DRAM)
2. IBM ARTIC 960 4-port Application Interface Board (AIB)
3. ARTIC 960 AIB Cable (V.36, EIA530, X.21, or V.35)

ARTIC is IBM's acronym for A Real-Time Interface Co-processor.

The ARTIC 960 PCI Adapter is a high-speed, high-throughput intelligent coprocessor PCI adapter designed to relieve host CPUs from compute-intensive tasks associated with I/O communication applications. Stratus' Continuum Series 400 uses the ARTIC 960's Intel 80960CF microprocessor to off-load synchronous communications I/O tasks.

For serial communications applications, a high-speed, 4-port multi-interface AIB is mated to the ARTIC

960.

The 4-Port AIB has one 100-pin D-shell connector that connects to a fan-out cable that separates into multiple ports. Ordering a U403-01 provides an ARTIC 960, a 4-port AIB, and an AIB cable that fans out into four DB37M connectors adhering to V.36, that is, ISO 4902.

The U403-02 provides an ARTIC 960, a 4-port AIB and an AIB cable that fans out into four DB25M connectors adhering to EIA530, that is, RS-422.

The U403-03 provides an ARTIC 960, a 4-port AIB and an AIB cable that fans out into four DB15M connectors adhering to X.21 that is, ISO 4903.

The U403-04 provide an ARTIC 960, a 4-port AIB and an AIB cable that fans out into four M/34 male connectors adhering to V.35.

Marketing ID	Ports	Interface	Connector
U403-01	4	ISO 4902 (V.36)	DB37M
U403-02	4	EIA530 (RS-422)	DB25M
U403-03	4	ISO 4903 (X.21)	DB15M
U403-04	4	V.35	M/34

The actual speeds supported by Continuum 400 systems are software dependent. Refer to the OS literature for more detailed specifics within each operating environment and protocol.

5.2.3.2 U404 8-port 4-MB Synchronous Adapter

U404s are similar to U403s in that they have the same IBM ARTIC 960 co-processor platform. However, the U404s employ Cipher’s Application Interface Boards (AIBs). They also use fan-out cables that provide eight DB25M connectors adhering to EIA232.

The adapter hardware of the U403/404 is capable of the following speeds:

Interface	Maximum Speed
RS-232 (async)	38.4 Kbps
RS-232 (sync)	64 Kbps
RS-422	2.048 Mbps

ISO 4902 (V.36)	2.048 Mbps
ISO 4903 (X.21)	2.048 Mbps
V.35	2.048 Mbps

The actual speeds supported by Continuum 400 systems are software dependent. Refer to the OS literature for more detailed specifics within each operating environment and protocol.

5.2.3.3 U420/420E T1/E1 ISDN Adapter

The U420/U420E is manufactured by ITK Telekommunikations AG and is known commercially as the ITK ix1-primary. The U420 is used to provide both T1 (1.544 Mbps) and ISDN PRI interfaces. The U420E is used to provide E1 (2.048 Mbps) and Euro-ISDN PRI interfaces. Full channel and channelized (N x 56 / 64 Kbps) operation are supported. The U420/U420E sports a single RJ48C port that can also be used for ISDN Primary Rate Interface (PRI) connections—both North American (23B+D) and European (30B+D) standards. Specifically, DSS1 (Euro-ISDN/NET3/ETSI), National ISDN-1/ISDN-2 (USA), NI1/2 (USA) ISDN PRI signaling are supported.

With a B333 RJ48C-to-BNC cable, a U420E can provide a G.703 interface.

The U420/U420E uses a 30 MIPS RISC CPU with 16 MB of RAM to off-load Continuum 400 CPU processing. Both CAPI and CAPIplus (the high performance extensions to provide channel bundling, data compression, extended security services and MVIP) are supported.

5.2.3.4 U450 Asynchronous Adapter

The U450 PCI card is a half-size form factor asynchronous adapter (3.75 in. by 5 in.) manufactured by DigiInternational. Its supplied power is 3A, at +5VDC $\pm 5\%$ and its operating temperature range is 0 ° to 55° C.

The U450 has the following features:

- 100 baud to 230 Kbaud transfer rate
- Conforms to EIA-STD-232 standard
- 128 KB of buffer memory
- Eight channels of RS-232 connections (78-pin D-type female high density connector fans out to eight standard DB-25 connectors)
- Supports BIST/POST
- Full duplex capability
- PCI bus slave operations only
- 16C554 quad asynchronous communication controller
- Standard 1488 liner drivers and 1489 receivers
- 1N4004 diodes provide +/- 12 volt over-voltage protection

- Standard RS-232 cable

5.2.3.5 U501 Single-ended SCSI Adapter (DPT PM3224W)

The U501 single-ended SCSI adapter is a fast wide 16-bit SCSI host adapter and RAID (Redundant Array of Inexpensive Drives) controller. It contains three physical SCSI ports, two with internal connectors, and one external. The internal connectors are used for driving the integrated disk drives. The external connector is for connecting an optional tape drive.

The U501 contains a MC68EC030 32-bit processor which operates at 40 MHz. The SCSI peripheral interface is implemented using a FAS366 SCSI controller chip. All SCSI bus drivers are built-in and conform to the SCSI-2 specifications.

The U501 supports basic disk and tape I/O via single and dual SCSI interfaces. Dual-initiators provide two paths to access SCSI devices to assure availability.

5.2.3.6 U502 Differential SCSI Adapter

The U502 PCI card is a high-performance Fast/Wide 16-bit differential SCSI adapter that connects external disk expansion cabinets to the PCI bus in a Continuum 400 series system. It contains three external ports marked A (port 0), B (port 1), and C (port 2).

The U502 is based on a 32-bit bus architecture that optimizes data flow between the system and the disk drives, resulting in the highest possible throughput with low CPU utilization. It contains 8 MB cache. A flash PROM is used to store program code. The U502's synchronous SCSI data transfer rate is 10 MB/s in Fast 8-bit mode and 20 MB/s in Fast/Wide (16-bit) mode.

The U502 provides termination for single-initiator configurations. It does not provide termination for dual-initiator configurations.

5.2.3.7 U512 Ethernet Adapter

The U512 PCI card is a high-performance 2-port ethernet adapter that connects a Continuum 400 Series system to a local area network (LAN). The U512 is based on a 32-bit bus architecture that optimizes data flow between the system and the network, resulting in the highest possible throughput with low CPU utilization.

The U512 adapter provides both 10 Mbps regular ethernet and 100 Mbps fast ethernet communication. The card automatically senses the speed of the port to which it is attached and configures itself properly.

Each PA-8500 Continuum 400 Series system can support up to eight U512 cards. These cards can be paired using the redundant network (RNI) to provide backup fail-over protection.

5.2.3.8 U513 Ethernet Adapter

The U513 PCI adapter is a high-performance, single port (RJ45) 10/100 MB/sec ethernet card manufactured by Rockwell Network Systems (RNS). It's based on a 32-bit bus architecture that optimizes data flow between the system and the network, resulting in the highest possible throughput with low CPU utilization.

With Category 3 wire, the U513 operates at 10 MB/sec.; with Category 5 wire, it can operate at either 10 MB/sec or 100 MB/sec. The U513 supports half duplex 10BaseT and 100BaseTx operation. The card automatically senses the speed of the ethernet, and configures itself properly.

5.2.3.9 U520 Token Ring Adapter

The Continuum Series 400 employs the U520 PCI adapters to provide Token Ring LAN interfaces.

The U520 is manufactured by the Racore Corporation and is known commercially as the M8154. The U520 is compatible with the IEEE 802.2 and 802.5 standards, as well as the PCI Specification 2.1. Its Token Ring interface is based on the Texas Instruments TMS380-C30 chip set. The M8154 PCI adapter provides a choice of connectors: an RJ45 for use with Type 3 UTP cable, or a DB9 for use with Type 1 STP cable. Only one interface (RJ45 or DB9) can be used at any one time. Either connector can be used for 4 or 16 Mbps operation. The U520 automatically senses which connector is being employed and the speed of the attached token ring LAN. One pair of amber/green LEDs indicate the speed visually: amber for 16 Mbps; green for 4 Mbps.

Racore's high speed burst mode bus transfer DMA off-loads the CPU and minimizes I/O bottlenecks. Its Frame Processing Accelerator (FPA) can eliminate receive congestion errors, improving throughput and overall network performance.

5.2.4 PCI Subsystem Cooling

PCI subsystem cooling is accomplished through the air flow provided by the suitcase fans located in the top of the suitcases, which reside directly below the PCI card cages. Sufficient air movement is provided to ensure that the PCI cards meet operational specifications up to 50° C during the removal of one suitcase or the failure of the fans in one suitcase.

5.3 Disk Subsystem

The disk drives are standard 3.5" 9-MB and 18-MB hard drives operating at 10 K RPM. They reside in the two disk enclosures (A and B) located directly above the PCI card cage. Each disk enclosure is a highly integrated, modular enclosure that houses up to 7 SCSI disk drives, two 48 VDC power supply modules, three cooling fans, a SES (SCSI Enclosure Services) unit, a SE-SE (single-ended to single-ended) I/O repeater module, and a terminator module.

The maximum number of disk drives in the system is 14. The maximum duplexed disk storage is 126 GB. Each disk drive in the top enclosure (Tray 0) is mirrored with the disk drive directly below it in the bottom enclosure (Tray 1).

The disk enclosure connects to the 7 disks using 80-pin, hot-pluggable connectors. The disk enclosure can operate with only one power supply installed; however, if full power redundancy is required, then both power supply modules must be installed. The cooling strategy is also fault tolerant - only two out of the three fans are needed to adequately cool a fully configured disk shelf.

The disks within the enclosure are configured as a single SCSI bus. The backplane, terminator, and SES

unit are designed to support single-ended (SE) SCSI operation. Optional I/O modules are available to allow extended length SE operation. All connections to the enclosure (SCSI, I/O & power) are located on the rear of the enclosure.

Other features of the disk subsystem are:

- Disk drive spin-up under host control (no delay).
- Operates at 20 MB/sec (Fast/Wide) SCSI.
- Automatic assignment of SCSI IDs.
- Dual 48 VDC power supplies with isolated inputs.
- 48 VDC power supply operation (260 Watts).
- Power and cooling to support 10K rpm disk drives.
- Redundant (N+1) cooling fans w/ LED fault indicators.
- An impedance controlled, totally passive backplane that supports SE operation.
- SE-SE repeater module extends SE SCSI operation up to 3 meters external.
- Enclosure status and control reporting the following via in-band SCSI (SES Unit):
 - Disk enclosure temperature
 - Cooling fan status
 - Power supply status
 - Host control of disk fault LED
 - Disk drive present/absent status
 - Disk drive inserted/removed status
- SES unit is hot-swappable.
- Designed to exceed FCC Class B limits as a single unit.

5.3.1 Input DC Power

The PA-8500 400 Series system distributes only 48 VDC power to the disk shelves. The DC input power connector is a D-type subminiature connector. The DC-powered disk shelf does not use chassis ground. The internal wiring harness is protected by fuses.

The following table shows the pin-out configuration for the input power connector.

Pin #	Signal Name/Function
A1	48 VDC A Power
A2	48 VDC A Return
A3	48 VDC B Return
A4	48 VDC B Power

5.3.2 Disk Enclosure Components

The disk shelf backplane is the heart of the enclosure. It distributes the SCSI bus and power to all of the drives and provides the interconnection between all other modules that are plugged into it. The disk slots bring the SCSI bus and power connections to each disk drive. Each slot has two LED's associated with it. The first is a green LED that is driven by the LED_OUT signal directly from the drive, and the second is a red LED driven by the SES unit. There is also a Drive_Present signal that is monitored by the SES Unit. This signal is used to detect the presence or absence of individual disk drives within the enclosure.

The power supplies are installed from the front of the shelf. They are 2N supplies providing fault tolerant power and are rated for a high output of 260 watts max./300 watts peak. The power supplies are located at the two left-most slots of the disk enclosure. These slots are dedicated as power supply slots only; a disk drive cannot be inserted into these slots. The input power for these slots is individually connected to the mains input connector. The green LEDs for these slots are driven by the power supply present signal from each of the respective power supplies. The green LED will not light if the input power to the power supply is not present. These LEDs indicate that the power supplies are receiving good input power. The red LEDs for these slots are driven individually by the SES unit. These LEDs indicate that the power supply is broken, and is not supplying its share of power to the load.

The disk drives are 16-bit wide single-ended SCA-2 drives manufactured by Seagate. They have the following features:

- Rotational speed of 10,000 RPM
- Operate at 20 MB/sec (Fast/Wide) SCSI
- Direct connect to backplane via SCA-2 connector (no internal flex cables)
- Fault and status indicators
- Single button release
- One piece aluminum canister
- Disk firmware is downloadable
- (PRML) read channel electronics
- Embedded servo technology
- Wide Ultra2 SCSI interface
- Dual Stripe Magneto-Resistive (DSMR) Head Technology, which provides a differential signal, to reduce noise.
- Higher density media for increased BPI (bits per inch)

MTBF (Mean Time Between Failures) of the disk drives is 300K hours.

The SES unit is located on the rear of the disk enclosure. The SES unit provides continuous monitoring and control of the disk shelf. It is responsible for monitoring the disks, power supplies, fans, and temperature of the shelf. It also controls various LEDs and the fan speed.

The SES unit reports status to the host and receives control information via the SCSI bus (per the SCSI-3 Enclosure Services Specification) as opposed to a separate cable. It accomplishes this task by using the SCSI SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands to obtain

configuration information for the enclosure and to set and sense standard bits for each type of element that may be installed in the enclosure. Since the SES unit communicates over the SCSI Bus, it consumes a SCSI ID.

In the event of an SES failure, no data is lost and no disks become unavailable. What is lost is the information pertaining to the status of power supplies, fans, and temperature within the enclosure. In addition, the information about the configuration of the enclosure, (which disk slots are occupied, which are empty) will be unavailable. Finally, the ability to control the red disk LED will be absent and any LEDs which were lit will be dark. During the failure or absence of the SES unit, the fans will run at full speed (100%) regardless of temperature.

Like the SES unit, the SE-SE I/O repeater and terminator module slots are located on the rear of the disk shelf. There are two slots dedicated for the modules, and either slot can be used for the SE-SE I/O repeater module or the termination module.

The SCSI bus is single-ended, FAST/WIDE (20MB/sec). Due to physical and cabling restraints, the SE-SE I/O repeater module is needed to ensure enough margin of the signal integrity. It allows the SCSI Bus to be extended 3 meters from the connector.

When the SE-SE I/O repeater module is plugged into the disk shelf, the backplane, disks, SES unit, and terminator module all operate in SE mode. The SE-SE I/O repeater module effectively cuts the SCSI bus in half, making two physical busses behave as a single logical bus. Since the SE-SE I/O repeater is an integral component of the SCSI bus, a failure results in a loss of connection to the disks. Connection from the outside world to the internal backplane SCSI bus is through the repeater module.

The terminator module installs into one of the I/O slots located on the rear of the shelf. For consistency, it is installed in the slot closest to the input power connector.

The terminator module is a multi-mode terminator. It operates in SE mode and provides automatic termination of the SCSI Bus on the backplane. Since the terminator module is an integral component of the SCSI Bus, a failure results in a loss of connection to the disks. It is **not** hot-swappable. Pulling the terminator causes the SCSI Bus to become disabled.

There are two green LEDs located on the terminator module. The one marked **SE** should be on to indicate the SCSI Bus is operating in SE mode.

5.3.3 Disk Configurations

The disk drives are controlled by the U501 PCI SCSI controllers configured as dual-initiated Host Bus Adapters (HBAs).

The following table shows the disk shelf enclosure slot assignments.

Slot #	8	7	6	5	4	3	2	1	0
Component	PS 1	PS 0	Disk 6	Disk 5	Disk 4	Disk 3	Disk 2	Disk 1	Disk 0

The table below shows the SCSI IDs for the disk drives and SES unit.

Slot #	8	7	6	5	4	3	2	1	0	SES Unit
--------	---	---	---	---	---	---	---	---	---	----------

Drive #	PS 1	PS 0	6	5	4	3	2	1	0	N/A
SCSI ID	n/a	n/a	14	5	4	3	2	1	0	15

NOTE: HBA 0 and HBA 1 (U501s) are always set to SCSI ID 6 and 7, respectively. SCSI IDs 8-13 are reserved for expansion.

The PA-8500 system does not daisy-chain disk shelves. Each shelf is a fully independent storage node; fault-tolerance is achieved by duplication of hardware, independent power and data paths, and mirroring data across the shelves.

5.3.4 Disk Subsystem Cooling

The disk shelf provides front to back airflow cooling via three variable speed cooling fans. The fans are hot-swappable and redundant. Each fan RPM is monitored and each fan unit has a red fault indicator located on the fan assembly. As viewed from the rear of the disk shelf, fan numbering is as follows: Fan 0 is at the left, Fan 1 in the middle, and Fan 2 at the right.

Under normal operating conditions, all three fans should be installed at all times, a missing fan will disrupt the normal path of airflow from the front to the back. Although only two fans are needed to cool a maximum configured disk shelf, three are used for fault tolerance. Swapping of a fan module must be limited to a time duration of 5 minutes or less.

The fans are variable speed (from 50% for low noise and increased MTBF, up to 100%). All three fans in the shelf operate at the same speed, as this is a function of the control sent by the SES Unit. The SES Unit sets the fan speed depending upon ambient temperature and failure status. The fans are set to high speed if one or more fans are detected to have failed. The fans are also set to high speed if one or more power supplies are detected to have failed. In the case of a missing or broken SES unit, the fans default to full speed.

The direction of airflow is from front to back. Cooling air is drawn in through the disks and power supplies, goes through the backplane, and is exhausted out by the three fans. Holes in the backplane control how much cooling air is allowed to pass through each of the slots. An air plenum, located in the rear, ensures that the airflow is uniform regardless of which fan may fail. This arrangement of plenum and air volume holes works extremely well provided that all the "holes" are plugged. This means that every slot in the front must have either a disk or power supply properly installed, or in the case of a less than maximum configuration, must have a disk filler panel installed in any unused slots. In addition, all three fans must always be installed, regardless of whether they have failed. (In other words, do not remove a failed fan and operate the enclosure with the fan missing.) The enclosure is designed to operate with "holes" for a maximum of 5 minutes.

5.3.5 Disk Subsystem Cabling

The disk shelf uses the following cables:

Cable Type	Part Number
Disk SCSI cable	AW-001034

Cabinet power cable	AW-001038
Disk power "Y" cable	AW-001036

5.4 Power and Control Subsystem

The power subsystem consists of an AC front end unit (Tray 1) and a power shelf (Tray 2). Both are located in the upper section of the cabinet.

5.4.1 Power Tray 1

Tray 1 converts AC power into 48-volt power and supplies 2000 watts of redundant power . It supplies the suitcases, disks, and Tray 2 with 48 VDC power. The architecture used in Tray 1 is 2N architecture, consisting of two autonomous 2.0 KW power sources feeding the 48-volt components within the cabinet directly, and also feeding two PCI power supplies located within Tray 2. AC input to Tray 1 is 208-240 VAC, single phase. The MTBF is >300,00 hours.

Tray 1 contains the following:

- 2 AC-to-DC power supplies (redundant, hot swappable, interchangeable)
- 2 Circuit breakers
- 2 AC input power connectors
- Backplane
- LED status indication

Two AC inputs each feed one-half of the Tray 1 power supplies. Each half of Tray 1 outputs independent 2Kw of power at 48 volts. The system is normally equipped with two single phase 20-amp AC line cords. The DC output voltage of Tray 1 is regulated to 48 volts +/-5% tolerance. The 48-VDC output bus is two separate distribution paths, each of which can maintain full system operation in the event of a DC distribution path loss.

A 50/60-Hz circuit breaker resides in each PSU with manual ON/OFF capability from the front of the PSU. One breaker protects the A-side PSU and the other breaker protects the B-side PSU. Each breaker contains remote sense reporting to the maintenance system. Each circuit breaker interrupts both the AC HOT and AC NEUTRAL circuit paths.

Two IEC 320 AC input connectors are located on the rear of Tray 1 and are part of the interface cable assembly. These connectors have 3 pins and are rated for 16 amps at 200/240VAC.

No internal battery backup capability is needed and power system CRU upgrades can be completed while the system is online.

5.4.2 Power Tray 2

Tray 2 accepts two 48 VDC inputs from Tray 1 and provides output power to operate two PCI-based I/O subsystems. It collects and communicates internal fault information to the system processor and controls

fault indicators located on the top and rear of the cabinet.. Tray 2 also supplies the power for the alarm control units (ACU). It contains the following components:

- 2 PCI power supplies with internal fans (forced convection)
- 2 Alarm control units - natural convection cooled
- Power backplane
- 2 Circuit breakers
- LED status indication

Each PCI power supply accepts a single 48 VDC source. Each PCI power supply has four outputs, three of which are independent sources to one side of the PCI-based I/O Subsystem. The fourth output of each PCI power supply is wire ORed together to provide a fault tolerant source for the system clock and SCSI bus termination.

If one PCI power supply fails, only the PCI cardcage powered by that power supply will be brought down. The other side will not be affected. A failed PCI power supply can be replaced while the system is online.

Each Alarm Control Unit (ACU) accepts a 12 VDC source from each of the PCI power supplies. The ACU collects fault and status information from the four power supplies and four input circuit breakers within Tray 1 and Tray 2. The ACU also controls the cabinet fault indicator located on the top of the cabinet in both front and rear. Power tray fault and status information is passed to the system CPU over an RS-485 protocol communication network.

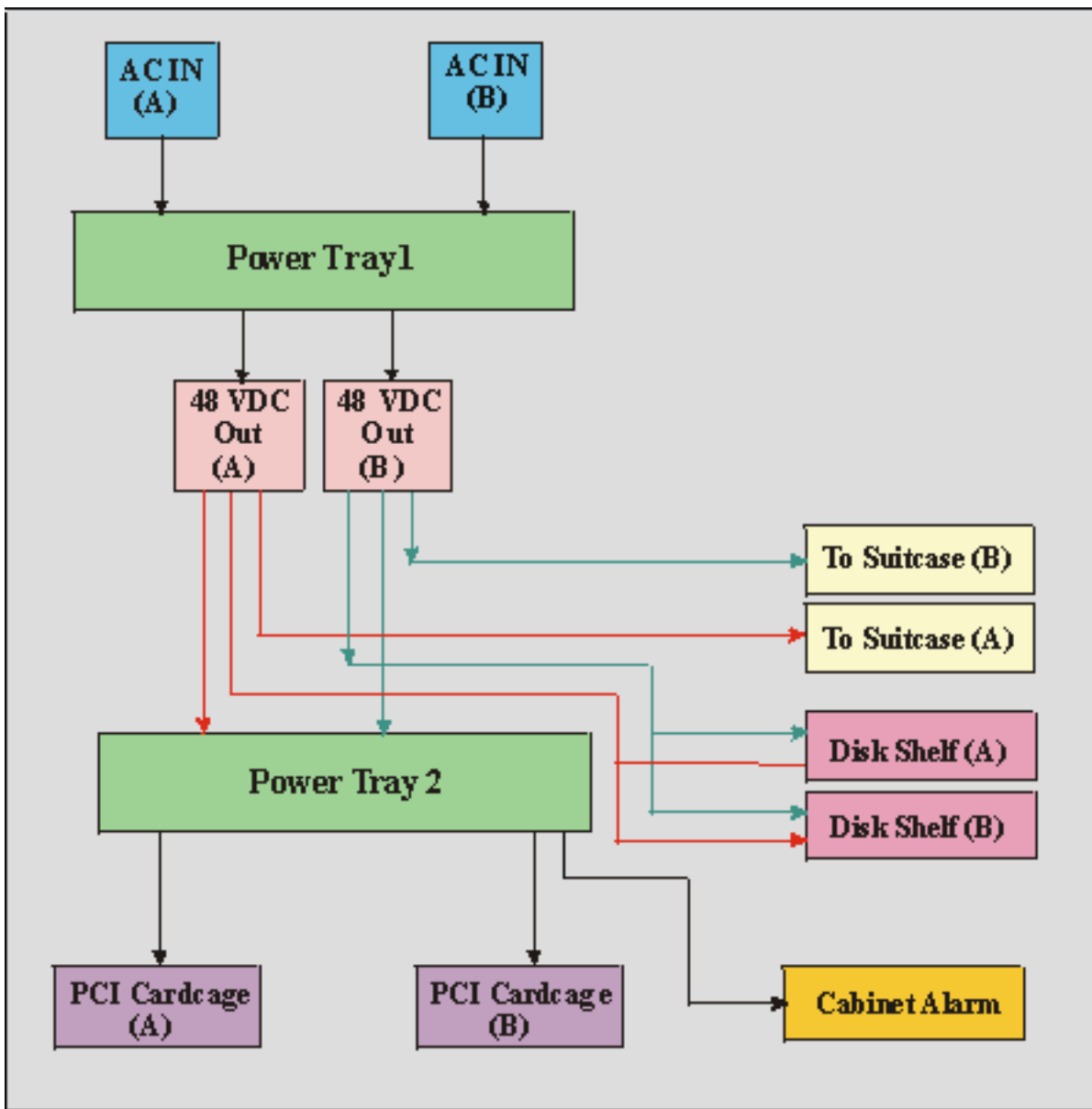
The power backplane interconnects power distribution, status, fault and control signals from Tray 1 and to the system maintenance system. It provides a power/signal connector interface to each PCI subsystem, the system backplane, and the cabinet fault indicator. Each CRU mates directly to a connector on the front facing side of the backplane while all the system interfacing is done via connectors on the rear of the backplane.

Two 10-amp circuit breakers are used to limit the 48 volts to the PCI power supplies. One interrupts 48 VDC (A) and the other interrupts 48 VDC (B). The breakers are sensed remotely by the maintenance system.

All CRUs within Tray 2 provide visual indication (LEDs visible from the front) when a fault occurs to aid in the repair process. Component faults are communicated to a maintenance system.

Figure 5-4 is a wiring diagram showing how the power is distributed.

Figure 5-4. System Level Wiring Diagram



5.4.3 Power Specifications

The power requirements for PA-8500 Continuum 400 Series systems are shown in the following tables.

AC operating parameter	Minimum	Maximum
AC input voltage	180 VAC	264 VAC
AC input frequency	47 Hz	63 HZ
AC current available per line cord		20 Amps
Source power factor @ Po>25%, Vin=nominal	0.80	1.0
Tray 1 power factor @ full load	0.90	

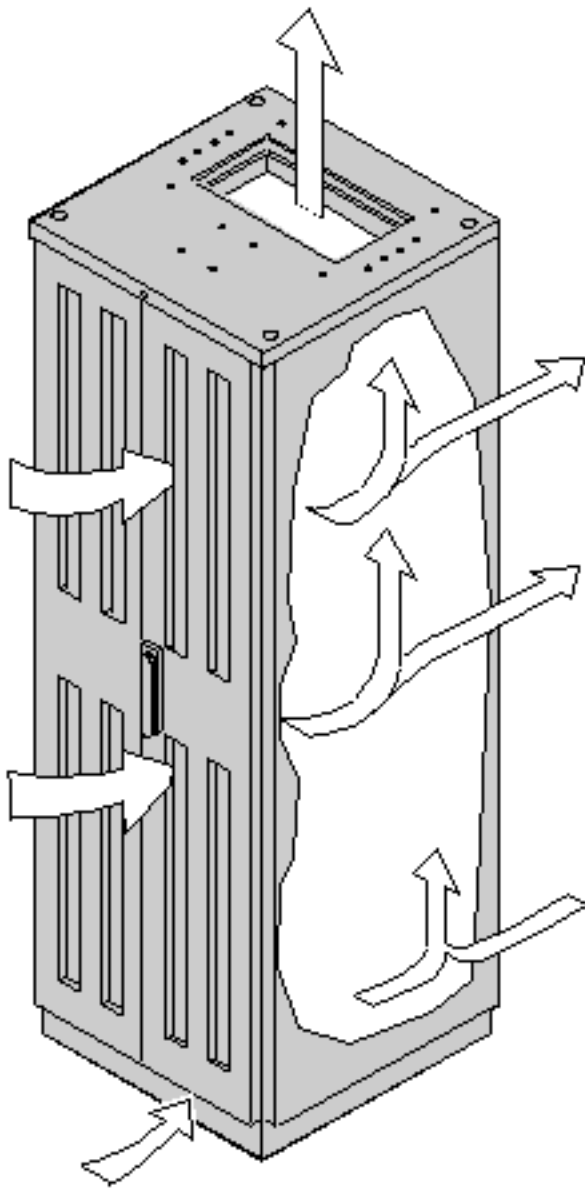
Steady state: AC input KVA AC input Watts	N/A	2.4 KVA 2200 Watts
--	------------	-------------------------------

DC output parameter	Minimum	Typical	Maximum
Output voltage	45.6 VDC	48 VDC	50.4 VDC
Output voltage set point	N/A	48 VDC	N/A
Output over voltage set point	50.4 VDC		52.8 VDC
Output current (Rated at Vo = 48 VDC	0 Amps		42 Amps
Output power: (Configuration dependent)	0 KW		2.0 KW
Over current limit	50		60 Amps
Output regulation (each) Line (Vi=180-264VAC) Load (Io=0A-42A) Temp (Ta=0 C to 50 C)			5%
Output Ripple (per PS)			1% P-P
Output turn-on overshoot (Measured from steady state output voltage of 48 Vdc)			2.4 VDC

5.5 Cooling Subsystem

PA-8500 Continuum 400 Series systems are cooled by bottom-to-top, front-to-back air flow, as shown in Figure 5-5.

Figure 5-5. System Air Flow



cp0167

The cooling system cools internal cabinet components by drawing air in through the front of the cabinet and exhausting it out the rear and top as follows:

- Two fans at the top of each suitcase draw air through the bottom of the cabinet to cool the boards within the suitcase.
- The air exhausted through the top of the suitcases is drawn upward to cool the PCI cards and is exhausted through vents in the rear of the card cage.
- The air evacuated through the top of the suitcases and into the middle interior of the cabinet cools the components in the upper enclosures.
- Three fan modules at the rear of each disk shelf draw air through the disk drives from the front of the cabinet and exhaust it upwards from the rear.
- Fans in the front of each disk and PCI power supply draw air through the power supply units and exhaust it through the rear of the units.

Each disk power supply contains a fan. If one of these fails, the fan in the other power supply shifts to high speed to compensate for the loss. It returns to normal operation when the failed disk power supply is replaced. Each PCI power supply has one, fixed-speed fan, so there is no shift to high-speed operation when one PCI power supply fails.

Each suitcase has two fans. If one fan in a suitcase fails, the suitcase takes itself out of service, and the two fans in the other suitcase shift to high speed. The disk shelf fan modules, at the rear of the system, cool the disk shelf. If one of these fans fails, the other fans shift to high speed to maintain an adequate level of cooling. When the failed fan is replaced, the other fans eventually return to normal operation.

Obstructed ventilation can overheat the system and cause part failure. The system requires 2 ft. (0.6m) of clearance on the front and rear of the cabinet and a minimum of 1.5 ft (0.5m) of unobstructed area above the cable trough on the top of the cabinet.

6. Part Numbers

The tables in the following subsections list the part numbers for the Customer Replaceable Units (CRUs), Field Replaceable Units (FRUs), and Distributor Replaceable Units (DRUs) in PA-8500 Continuum Series 400 systems.

6.1 Suitcase

Description	FRU/CRU/DRU	Part Number
Uni 360 MHz Suitcase (1.5 MB cache)	CRU	AA-G26200
Twin 360 MHz Suitcase (1.5 MB cache)	CRU	AA-G27200
0.5 GB Memory Board	DRU	AA-M71500
2GB Memory Board	DRU	AA-M71700

6.2 PCI Subsystem

Description	FRU/CRU/DRU	Part Number
PCI bridge card (includes PCMCIA flash card)	CRU	AA-K13810
PCMCIA flash card (20-MB)	CRU	AA-E52500
4-port, 4-MB synchronous card, V.36 w/cbl	CRU	AA-U403-01
4-port, 4-MB synchronous card, EIA232 w/cbl	CRU	AA-U403-02
4-port, 4-MB synchronous card, X.21 w/cbl	CRU	AA-U403-03
4-port, 4-MB synchronous card, V.35 w/cbl	CRU	AA-U403-04
8-port 4-MB synchronous card (RS-232)	CRU	AA-U40400
4-port, 4-MB synchronous card, V.35 with OpenCall	CRU	AA-U41100
8-port, 4-MB synchronous card, V.35	CRU	AA-U41200
4-port /8 link T1/E1/ISDN card with OpenCall	CRU	AA-U41500
4-port /16 link T1/E1/ISDN card	CRU	AA-U41600
1-port T1/E1/ISDN card	CRU	AA-U42000
8-port Asynchronous PCI adapter	CRU	AA-U45000

Fast wide single-ended SCSI adapter	CRU	AA-U50100
Differential SCSI adapter	CRU	AA-U50200
Differential for EMC Symmetrix	CRU	AA-U50300
2-port ethernet card (10/100 Mbps)	CRU	AA-U51200
1-port 10/100 MB adapter	CRU	AA-U51300
1-Port 4/16 Mbps Token ring adapter	CRU	AA-U52000
1 Port Desktop ATM PCI Adapter	CRU	AA-U54300
SCSI data cable (PCI bridge card to backplane with terminator)	FRU	AW-001047
U450 16-port DB25 support bracket kit	FRU	AW-000331
U450 (RS-232) cable	CRU	AW-001006
Bxxxxx T1/E1 cable	CRU	AW-Bxxxxx
U404 (RS-232) cable	CRU	AW-B23000
U403-04 (V.36)cable	CRU	AW-B16500
U403-04 (RS-422)cable	CRU	AW-B16200
U403-04 (X.21)cable	CRU	AW-B16300
U403-04 (V.35)cable	CRU	AW-B31000

6.3 Power Subsystem

Description	FRU/CRU/DRU	Part Number
AC to 48 volt Power Front End (Tray 1)	FRU	AA-P28200
Power Supply	CRU	AA-P28201
PCI/ACU Power Tray (Tray 2)	FRU	AA-P28300
PCI power supply	CRU	AA-P27200
System Power Cbl AC/ 250v/20amp line cord, domestic	CRU	AA-B19013
Ground cable	CRU	AW-001005

6.4 Cabinet

Description	FRU/CRU/DRU	Part Number
Alarm control unit (ACU) PCB	CRU	AA-E25500
CPU backplane	FRU	AA-E25800
Backplane interconnect PCB (PCI to CPU backplane)	FRU	AA-E26200
PCI backplane	FRU	AA-E26100
PCI fault display PCB	FRU	AA-E26600
Cable (PCI backplane to PCI fault display PCB)	FRU	AW-001113
Cabinet fault display PCB (PCI and cabinet)	FRU	AA-E26500
Cable (PCI backplane to cabinet fault display PCB)	FRU	AW-000959
Cable (Cabinet fault display PCB to cabinet fault LEDs)	FRU	AW-000985
ACU/CPU to fault display PCB cable	FRU	AW-000958
CPU backplane power cable	FRU	AW-001048
Disk power "Y" cable (disk shelf)	FRU	AW-001036
SCSI data cable (disk shelf)	FRU	AW-001034
Cabinet power cable	FRU	AW-001038
Power jumper cable	FRU	AW-001037
PCI backplane power cable	FRU	AW-001047
Disk shelf	FRU	AX-D84000
Air filter kit (4 filters and associated filter covers)	FRU	AK-000340
Air filter kit (4 replacement filters)	CRU	AK-000341
Air filter kit (4 replacement disk shelf filters)	CRU	MP-000705
9-GB 10,000 RPM disk drive	CRU	AA-D84100
18-GB 10,000 RPM disk drive	CRU	AA-D84200

DC Power Supply	CRU	AA-D84002
SE-SE I/O Repeater Module	CRU	AA-D84003
Disk Fan Module	CRU	AA-D84004
SE/LVD Terminator Module	CRU	AA-D84005
SES Module	CRU	AA-D84006
Disk Filler Panel	CRU	AA-D84092

6.5 Tape Drives/Modem/Terminals

Description	FRU/CRU/DRU	Part Number
1,2-GB QIC 1000 cartridge tape drive	CRU	AA-T80400
12-GB, DDS3 DAT tape drive (1 cartridge) tape drive	CRU	AA-T80500
72-GB, DDS3 DAT tape drive (6-cartridge autoloader) tape drive	CRU	AA-T80600
CDROM drive (40x)	CRU	AA-D85900
12-ft single-ended SCSI cable - U501 PCI card to T80X tape drives	CRU	AW-B21000-12
2-ft single-ended SCSI cable (for daisy chaining T80X tape drives)	CRU	AW-B20000-02
UL/CSA console cable (25')	CRU	AW-B15201-25
Single-ended SCSI terminator - T80x tape drive	CRU	JC-005TRM
European power cord set	CRU	AW-B12800-01
British power cord set	CRU	AW-B12800-02
Italian power cord set	CRU	AW-B12800-03
Australian power cord set	CRU	AW-B12800-04
Swiss power cord set	CRU	AW-B12800-05
Japan/U.S. power cord set	CRU	AW-B12800-06
RSN modem, U.S.	CRU	AA-C41900
RSN modem, U.K.	CRU	AA-C41901
RSN modem, Switzerland	CRU	AA-C41902
RSN modem, Sweden	CRU	AA-C41903

RSN modem, Spain	CRU	AA-C41904
RSN modem, South Africa	CRU	AA-C41905
RSN modem, Hong Kong	CRU	AA-C41906
RSN modem, Norway	CRU	AA-C41907
RSN modem, New Zealand	CRU	AA-C41908
RSN modem, Netherlands	CRU	AA-C41909
RSN modem, Malaysia	CRU	AA-C41910
RSN modem, Japan	CRU	AA-C41911
RSN modem, Italy	CRU	AA-C41912
RSN modem, Ireland	CRU	AA-C41913
RSN modem, Greece	CRU	AA-C41914
RSN modem, Germany	CRU	AA-C41915
RSN modem, France	CRU	AA-C41916
RSN modem, Finland	CRU	AA-C41917
RSN modem, Denmark	CRU	AA-C41918
RSN modem, Belgium	CRU	AA-C41919
RSN modem, Australia	CRU	AA-C41920
RSN modem, Poland	CRU	AA-C41921
RSN modem, India	CRU	AA-C41922
RSN modem cable (25 ft)	CRU	AW-B10102-25
V105 terminal	CRU	AA-V10500

6.6 Optional Equipment

Description	FRU/CRU/DRU	Part Number
Cabinet transporter	FRU	AX-000062
Seismic zone 4 mounting kit	FRU	AX-000063
Seismic zone 1 mounting kit	FRU	AX-000064
Suitcase CRU transporter	CRU	AX-000065

7. Related Documentation

7.1 Customer Service Documentation

- [*PA-8500 Continuum Series 400 Unpacking Instructions*](#)
- [*PA-8500 Continuum Series 400 Installation Guide*](#)
- [*PA-8500 Continuum Series 400 CPU/Memory Upgrade Procedure*](#)
- [*PA-8500 Continuum Series 400 Illustrated Parts Breakdown*](#)

7.2 Customer Documentation

Available through the [Copy Center](#) (Print on Demand)

- *Continuum Series 400 Site Planning Guide Release 1.0(R454-01-ST)*
- *HP-UX Operating System: Continuum Series 400 Operation and Maintenance Guide Release 1.0 (R025H-01-ST)*
- *Continuum Series 400 Tape Drive Operation Release 1.0(R719-01-ST)*
- *D859 CD-ROM Drive: Installation and Operation Guide Release 1.0(R720-01-ST)*
- *Continuum Series 400 Suitcase Replacement for the HP-UX Operating System Release 1.0 (R026H-01-ST)*
- *HP-UX Operating System: Peripherals Configuration(R1001H-04-ST)*
- *HP-UX Operating System: Installation and Update(R1002H-05-ST)*
- *HP-UX Operating System: Read Me Before Installing(R1003H-04-ST)*
- *HP-UX Operating System: Fault Tolerant System Administration(R1004H-04-ST)*
- *HP-UX Operating System: LAN Configuration Guide(R1011H-02-ST)*
- *HP-UX Operating System: Site Call System User's Guide(R1021H-01-ST)*
- *U403 Sync. PCI Card Installation Guide Release 1.0(R723-01-ST)*
- *U404 Sync. PCI Card Installation Guide Release 1.0(R725-01-ST)*
- *U420 T1/E1 PCI Card Installation Guide Release 1.0(R724-01-ST)*
- *U450 Async. PCI Card Installation Guide Release 1.0(R726-00-ST)*
- *U501 SCSI PCI Card Installation Guide Release 1.0(R721-01-ST)*
- *U512 Ethernet PCI Card Installation Guide Release 1.0(R722-01-ST)*
- *U513 Ethernet PCI Card Installation Guide(R706-01-ST)*
- *U520 Token Ring PCI Card Installation Guide(R713-00-ST)*
- *U530 FDDI PCI Card Installation Guide(R714-00-ST)*

7.3 Engineering Documentation

- *Stratus Configuration Specification Document No. ES-000121*

8. Upgrades

8.1 Upgrade Kits

The following table lists the marketing IDs of the CPU and memory upgrade kits for PA-8500 Continuum Series 400 systems..

Marketing ID	Upgrade Type	Description
UPM715-2	Memory	Add 0.5GB memory
UPM7644	Memory	Upgrade 1GB to 4GB memory
UPM7645	Memory	Upgrade 2GB to 4GB memory

8.2 System Upgrades

This section describes the steps needed to install a CPU or memory upgrade into a customer's system in the field for HP-UX systems.

CAUTION: ESD protection must be maintained for all parts of this process where the ESD covers have been removed from the CPU-Memory board.

In order to upgrade the CPU/memory modules on a CPU-Memory board, the components on the board must be at compatible revision levels. The configuration rules shown in this document are based on information available at the time of publication.

8.2.1 ESD Requirements

Since many of the components on the CPU-Memory board are particularly susceptible to ESD (Electro-Static Discharge), the CPU-Memory board must be protected from ESD. ESD protection kits must be employed when doing reconfigurations of Continuum suitcases.

The CPU/memory modules must also be protected from ESD before they are removed from their ESD-protected packaging, and while being handled.

To prevent equipment damage while handling components, take the following ESD precautions:

- A securely fastened ESD wrist strap **MUST** be worn at all times when removing the components.
- Avoid touching a component's leads or contacts.

Set up the ESD protection kit as close to the system as possible. Instructions for setting up the

rubberized mat, grounding wrist strap, etc. are supplied with the kit.

8.2.2 Upgrade Procedure

The procedure for upgrading CPU-Memory boards is performed in the following sequence:

- Burn the ID PROM on the CPU-Memory motherboard in the first suitcase.
- Burn the ID PROM on the CPU-Memory motherboard in the second suitcase.
- Shut down the system.
- Install memory modules on the CPU-Memory motherboards in both suitcases.
- Boot the system with the new configuration installed.

CAUTION: ESD protection must be maintained for all parts of this process where the ESD covers have been removed from the suitcase.

Before you begin the procedure, check the CPU/memory modules you will be adding to the system. Write down the following information for each component (listed on the bottom of each module) and indicate which suitcase (0/0 or 0/1) the component will be installed in.

- Subassembly model number (example: M717 in the part number AA-M71700).
- Sub model number (last two digits of the part number: example: 00 in part number AA-M71700)
- Serial number (example: 012192)
- Revision number (example: REV 34 or REV EE)
- Artwork revision number (two digits after the dash in the number etched near the edge of a memory module; example: 03 in the etching PC-M71700-03; or etched in a square on a CPU/cache module)

Note: The artwork revision number might be covered by a white sticker.

CAUTION: If a suitcase fails during the upgrade procedure, don't attempt to repair it. If the first suitcase you are upgrading fails, order two replacement suitcases (both of which are the upgraded model numbers). If the second suitcase you are upgrading fails during the procedure, order one replacement suitcase (upgraded model number).

The following subsections outline the procedure in detail. Be sure to follow the steps in the order they are listed.

8.2.2.1 Burning the Board ID PROM

1. Login as **root**.
2. Use the **update_idprom** command to burn one of the CPU-Memory motherboards (0/0 or 0/1) with the new ID PROM image.

Sample Command:

```
/sbin/update_idprom -h 0/0
```

where **-h 0/0** specifies the hardware path of the CPU/Memory motherboard to be updated.

NOTE: The suitcase must be online for **update_idprom** to access the CPU-Memory motherboard ID PROM.

The following screen appears.

```
Show/Add_subassembly /Delete_subassembly /Validate/Write/Exit?
```

If you need to remove any CPU or memory modules (when upgrading from one CPU or memory module type to another) from the CPU-Memory motherboard before upgrading it, go to Step 3. Otherwise, go to Step 6.

3. Enter **d** (for delete). A screen similar to the following appears showing all the subassemblies on the CPU-Memory motherboard.

index	model	serial	submodelx	rev	art
0:	G308	10091	0	73	0
1:	P230	199	0	5	0
2:	G826	1814	0	0	0
3:	G826	1832	0	0	0
4:	M715	0	0	0	0
5:	M715	0	0	0	0
6:	E275	12174	0	34	1

M715 is a 512-MB memory module; M717 is a 2-GB memory module. G826 is a uni processor module; G827 is a twin processor module.

4. Enter the number of the index for the first CPU or memory module you want to delete (e.g., **4**). A message similar to the following will appear.

```
Delete: model=M715 serial=0
[Delete] correct?
```

5. If the information is correct, enter **y** and repeat the process for any other CPU or memory modules that need to be deleted.

6. To add subassemblies, enter **a**.

The following screen will be displayed.

[Add] subassembly model?

7. Enter the required information for the CPU/memory module you will be installing on the CPU-Memory motherboard.

The subassembly models for memory modules are M715 (512-MB) and M717 (2-GB). The subassembly models for CPU modules are G826 (Uni) and G827 (Twin).

8. After you have entered the subassembly model and pressed the **Return** key, you are prompted for the following information on subsequent screens.

[Add] serial number?

[Add] submodel?

[Add] revision?

[Add] art revision?

Fill in the information as requested. When finished, a screen similar to the following will appear.

Add: model=M717 serial=0 submodel=0 rev=1 art_rev=0

[Add] correct?

9. If the information is correct, enter **y**.

The following screen appears.

Show/Add_subassembly/Delete_subassembly/Validate/Write/Exit

10. Repeat the process to add the remaining subassemblies.

11. When finished, enter **v** to validate the information.

A screen similar to the following appears.

CPU Board modelx **G827**, 360MHz Clock, 2GB Memory
Fru ID and Subassembly info validated.

Show/Add_subassembly/Delete_subassembly/Validate/Write/Exit'

NOTE: The validate command reads through the subassembly information, verifies that the information is correct, and updates several fields of the drom according to the subassembly information. An error message will appear if any of the following are detected:

- invalid number of memory modules

Upgrades

- memory modules are not all the same type
- G8XX subassembly is missing
- PXXX power supply subassembly is missing
- EXXX power supply interface card is missing
- subassembly model is unknown

12. If the validation is successful, enter **w** to write the information.

The following screen appears.

ID prom written and verified.

Show/Add_subassembly/Delete_subassembly/Validate/Write/Exit

13. Enter **e** to exit.

14. Repeat this procedure to update the CPU-Memory motherboard in the second suitcase.

15. When both CPU-Memory motherboards have had their ID PROM updated, proceed to the next section.

8.2.2.2 Installing CPU/Memory Modules

Follow the steps below to physically configure the CPU-Memory board by adding CPU and/or memory modules. The following table describes the upgrade options and their associated procedures.

Upgrade Option	Model Number	Procedure
0.5 GB to 1 GB Memory	M715	Install one M715 memory module in slot #1.
0.5 GB to 2 GB Memory	M717	Remove M715 memory module from slot #0. Install one M717 memory module in slot #0.
0.5 GB to 4 GB Memory	M717	Remove M715 memory module from slot #0. Install two M717 memory modules in slots #0 and #1.
1 GB to 4 GB Memory	M717	Remove M715 memory modules from slots #0 and #1. Install two M717 memory modules in slots #0 and #1.
2 GB to 4 GB Memory	M717	Install one M717 memory module in slot #1.
Uni to Twin Processor	G827	Remove Unit processor modules. Install Twin processor modules.

CAUTION: Be sure to follow all ESD precautions from this point on.

Upgrades

1. Shut down the system and turn off the main circuit breakers.
2. Remove the first suitcase (CRU) to be upgraded.
3. Loosen the two captive screws on the access door and open the door. (See Figure 1)

Figure 1. Opening the Access Cover

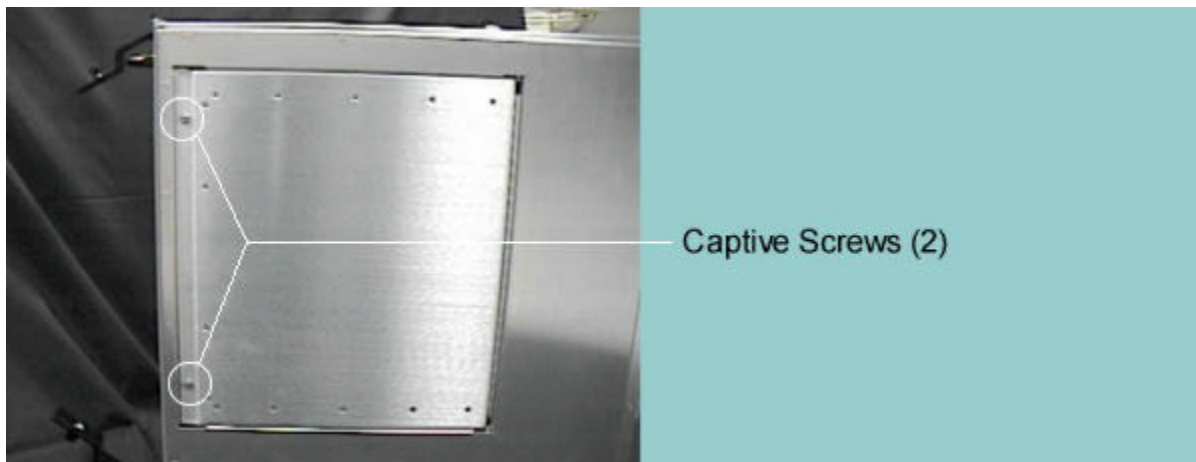
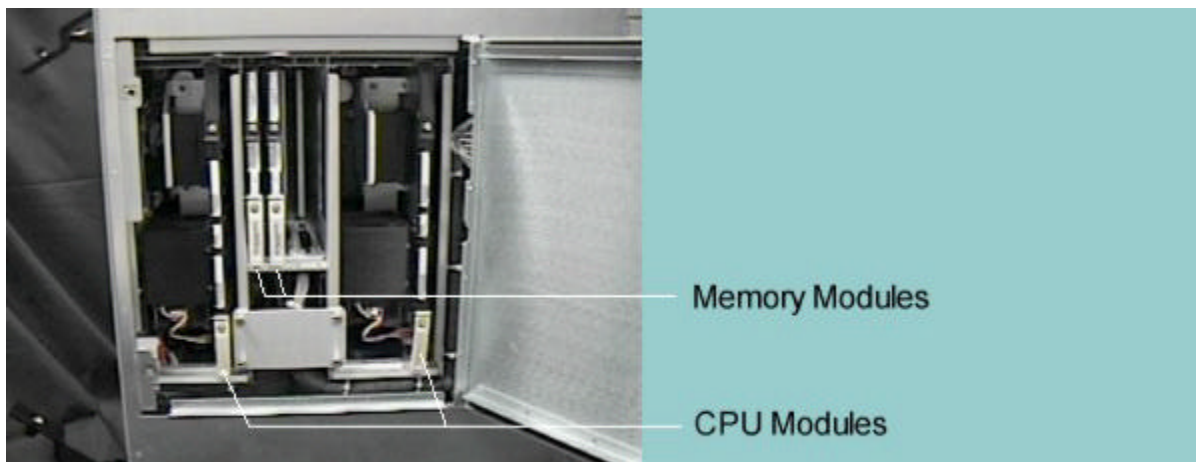


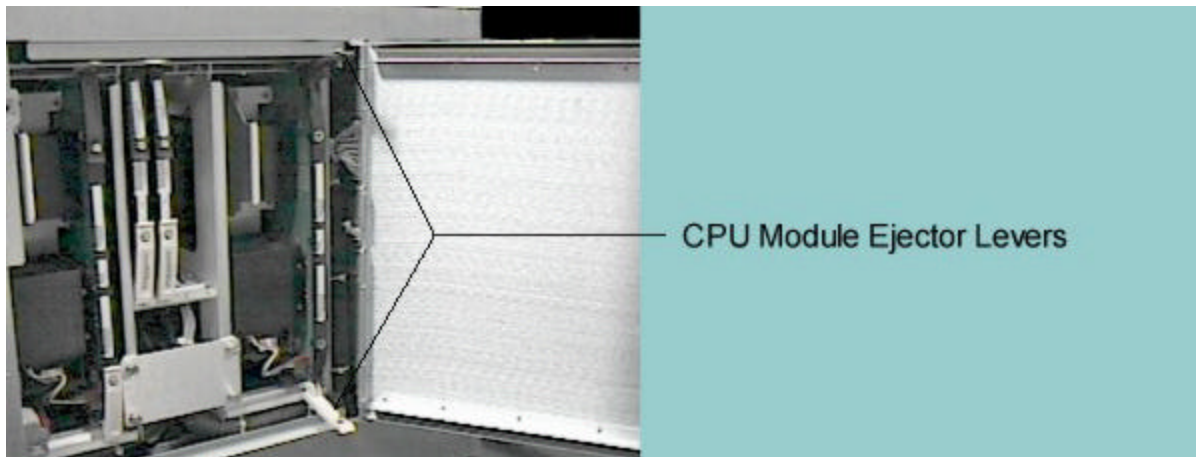
Figure 2 shows the location of the CPU and memory modules.

Figure 2. CPU and Memory Module Locations



4. If the CPU and/or memory module(s) being installed is not the same size as the module(s) previously installed, remove the previously installed module(s) by first loosening the captive screws on the module's ejector levers, and then releasing the levers and pulling the module straight out from the connector. (See Figure 3.)

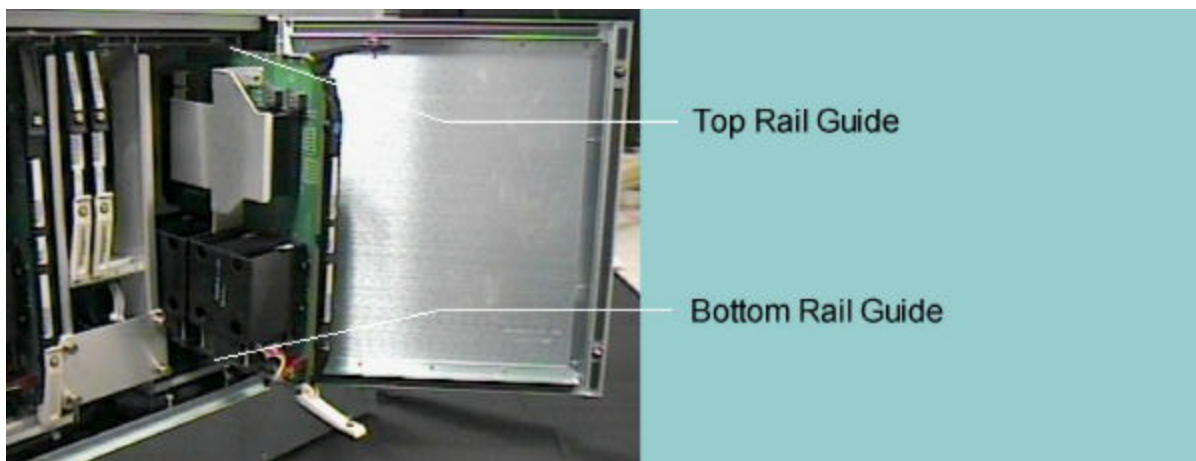
Figure 3. Removing a CPU or Memory Module



5. Install each new module by aligning it with the guide rails in the next available slot and sliding it all the way in until it is seated in the connector and then close the levers and tighten the captive screws 1/4 turn. (See Figure 4.)

CAUTION: When installing a CPU or memory module, make sure it is oriented properly. The white ejector lever is at the bottom and the black lever is at the top. Installing a module upside down can cause damage to the connectors.

Figure 4. Installing a CPU or Memory Module



6. When all CPU and/or memory modules have been installed, close the access cover and tighten the screws.

7. Replace the suitcase in the system cabinet and lock it in place.

8. Repeat the procedure for the other suitcase.

8.2.2.3 Verifying the CPU/Memory Upgrade

Upgrades

1. Turn on power to the system.
2. Execute the following commands.

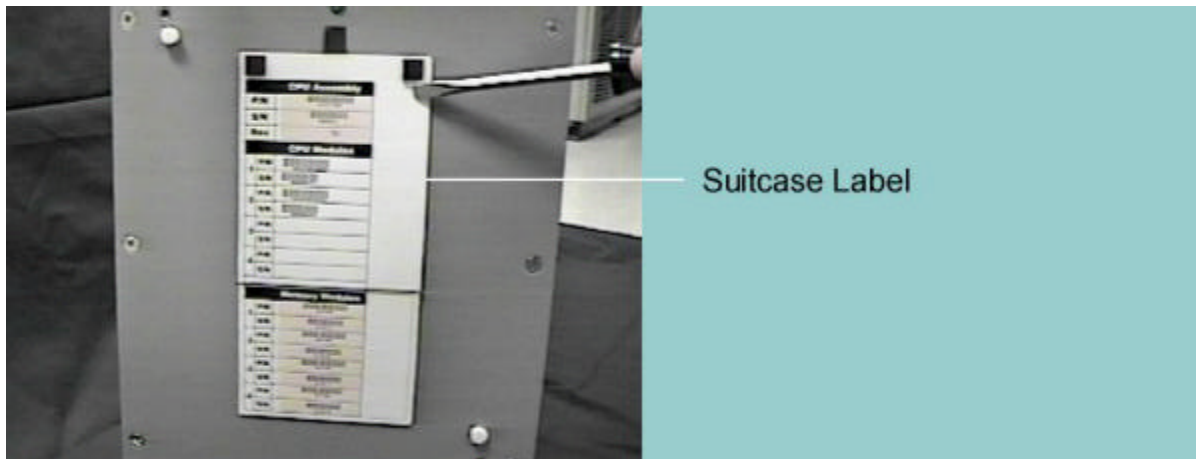
```
ftsmaint ls 0/0  
ftsmaint ls 0/1
```

Verify that the entry in the `Modelx` field is correct and the `Status` field is shown as `Online Duplexed` for each suitcase.

8.2.2.4 Updating the Suitcase Label

1. Locate the CPU/memory ID labels on the front bezel of the upgraded suitcases (See Figure 5).

Figure 5. Suitcase Upgrade Label



- 2 Open the ID label and install the label inserts provided with the CPU/memory upgrade kit.

8.2.2.5 Returning Parts

If any CPU/memory modules were removed, place them in anti-static bags and return them to manufacturing. Indicate on the outside of the bags that they are being returned because they were upgraded.